STEVE BELOVICH of BV Technologies will discuss current trends in, and the potential contributions of, areas of technology that are addressing urban environmental issues.

1:45 - 2:15 PM EDWARD COHEN-ROSENTHAL, Ph.D, Director, Work and Environment Initiative, Cornell University

2:15 - 2:45 PM STEVE BELOVICH, Ph.D., Vice President, BV Technologies, Cleveland

Session VI: Urban Environmental Issues and Policy

3:00 - 4:00 PM

Chair: SANDA KAUFMAN, Ph.D., Associate Professor of Urban Studies, Cleveland State University

3:00 - 3:30 Strategies to Build Sustainable Communities CHERYL LITTLE, Coordinator, Metropolitan and Rural Strategies Task Force, President's Council on Sustainable Development

3:30 - 4:00 Sustainable Development, Environmental Justice, and Information Technology: Development of Information Access Capacity at the Community Level. WENDY KELLOGG, Ph.D., Levin College of Urban Affairs, Cleveland State University

Panel Discussion:

4:15 - 5:30 PM
J. MORGAN GROVE, Research Forester, USDA Forest Service, and Invited Speakers.

Official Announcement

Saturday, April 24, 1999, 5:15 P.M.
Cleveland State University
Cleveland, Ohio
Main Classroom — Room 105

ANNUAL BUSINESS MEETING *FOR MEMBERS ONLY:*

There shall be an Annual Business Meeting for the membership of the Academy during the Annual Meeting. The business session shall be conducted in accordance with the most recently published edition of "*Robert's Rules of Order*". The order of procedure shall be as follows: A. A Call to Order by the President. B. A summary of the Minutes of the previous meeting shall be read by the Secretary. C. Presentation of the report of the tellers of the election of officers and other positions. D. Voting on any proposed amendments to the *Constitution* or *By-Laws*. E. Business from the floor. F. Adjournment.

Index to Poster and Podium Sessions

Saturday, April 24, 1999

See **Index to Authors** at end of program.

NOTE: UNDERGRADUATE RESEARCH-IN-PROGRESS REPORTS , as opposed to ABSTRACTS, are designated by having names of advisor(s) in (parentheses) following the name(s) of the students.

POSTER SESSIONS

University Center Atrium

PODIUM SESSIONS

POSTER SESSION

BIOLOGICAL SCIENCES

9:00-10:00 AM

UNIVERSITY CENTER

BOARD 1 AN EXPERIMENTAL EVALUATION OF PRIMARY CONSUMER COLONIZATION (DIPTERA: EPHYDRIDAE) IN RESTORED WETLANDS. MAGGIE CLARK AND BRUCE A. STEINLY, MIAMI UNIVERSITY, DEPT OF ZOOLOGY, OXFORD OH 45056.

This investigation documents changes in shore-fly (Diptera: Ephydridae) populations in restored wetlands. Previously, most wetland investigations have focused on plant communities, soils, hydrology, benthic invertebrates, and water fowl populations. Although one investigation focused on soil inhabiting Diptera (consumers of decaying vegetation) in a restored Florida wetland studies of primary consumer richness or abundance have not been reported, During 1997, a study of primary consumers at Miami-Whitewater Park (Hamilton Co., Ohio) suggested that unique shore-fly communities are habitat specific. Although spatial and temporal differences in shore-fly distribution were found, the relatively advanced stage of wetland development does not suggest how and when these habitats were colonized. In 1998, a study of shore-fly colonization of disrupted habitats within wetlands suggests that the cutting of *Typha latifolia* (cattail) contributed to an increase in shore-fly richness and abundance. Mud-shore habitat was initially colonized by *Discocerina obscurella* and *Polytrichophora orbitalis* (detritivores), and *Lytogaster furva*, *Lytogaster excavata*, *Scatella stagnalis*, and *Hyadina albovenosa* that utilize cyanobacteria. During the growth of sedges and grasses on mud shores, *Hydrellia griseola* and *Hydrellia tibialis* (leaf miners) abundance increased while detritivore numbers decreased. Analysis of shore-fly populations suggests that the abundance of *Hydrellia tibialis* is higher in restored wetlands than abundances found in older aquatic habitats. These restored wetlands may represent an intermediate stage of development within a continuum of successional stages that may have a direct effect on wetland food webs and vertebrate community composition.

BOARD 2 THE SUMMER SEASONAL EFFECTS FOUND IN PLANKTON, AMMONIA, NITRATE, AND PHOSPHATE IN THE PORTAGE LAKES. GREGORY M. WALKER (DR. CHARLES MCCLAUGHERTY), MOUNT UNION COLLEGE, 1972 CLARK AVE, ALLIANCE OH 44601.

The purpose of this study is to examine the changes of phytoplankton, zooplankton, ammonia, nitrate, and phosphate caused by precipitation during the months of June through August of 1998 in 4 of the lakes at Portage Lakes State Park in Summit County. The goal of this project is to determine if precipitation during the summer has a significant effect on the plankton count, ammonia, nitrate, and phosphate concentration levels. The hypothesis of this analysis is that precipitation will have a noticeable outcome in these 5 specific categories that are being tested. The analysis was completed by taking water samples once every 7 to 10 days in three different locations in four different lakes of the Portage Lakes State Park. Nine separate runs were made throughout the summer finishing with a total of 108 samples at varying depths. A pH and secchi depth tests were also taken for each individual sample. A rain gauge was used to measure precipitation and measurements were made before each individual run. These observations were recorded and all water samples were frozen until they could be analyzed by an electronic spectrophotometer which will distribute the concentration levels of nitrate, ammonia, and phosphate in each sample. These results will then be compared to the amount of precipitation received before the samples were taken. Graphs will then be designed to show this comparison and the possible changing effects due to rain.

BOARD 3 USING MICROBIOLOGICAL INDICATORS TO MONITOR THE WATER QUALITY OF THE PONDS IN THE BOHANNAN AND KRAUS NATURE PRESERVES. LAURA J. FRYBACK, HEATHER L. SMITH, AND LAURA TUHELA-REUNING, OHIO WESLEYAN UNIVERSITY, HWCC BOX 1437, DELAWARE OH 43015.

The quality of the waters of the ponds in the Bohannan and Kraus nature preserves was studied using microbiological parameters as indicators. These ponds represent three situations by which the water supply can be affected or contaminated by human activity. To address the issue of human and/or animal fecal contamination, *Escherichia coli* and the bacterial indicator groups of total coliforms, fecal coliforms, and fecal streptococci were monitored over a ten-week period. Concentrations of all these indicators were considered acceptable for primary and secondary recreation in untreated water in a nature preserve, according to standards set by the Environmental Protection Agency. Nitrate/nitrite levels as well as the presence/absence of nitrifying and denitrifying bacteria were monitored as indicators of the impact of agricultural run-off. Excess nitrogen and the presence of nitrifying bacteria in the Bohannan pond suggested the agricultural drainage basin impacted water quality. The biochemical oxygen demand (BOD_5) was highest (5.55 mg/l) in the small Kraus pond, as expected, because it is the smallest of the ponds studied and receives much organic matter from the surrounding trees and woodland run-off. The BOD_5 decreased in the large Kraus pond and the Bohannan pond, 1.60 mg/l and 1.35 mg/l, respectively, corresponding to an increase in pond size. A biofilm collecting device was designed and constructed to monitor the progression of biofilm formation in the ponds. Biofilms were collected over a 3 week period in the two Kraus ponds and examined using cryo-preservation scanning electron microscopy.

BOARD 4 A PRELIMINARY INVENTORY OF AQUATIC MACROINVERTEBRATE TAXA FROM RESTORED AND NATURAL WETLANDS OF THE BEAVERCREEK WATERSHED. MOLLIE D. MCINTOSH, JOSEPH S. VALAITIS, BRIAN T. CONDON, M. ERIC BENBOW, ALBERT J. BURKY, UNIVERSITY OF DAYTON, DEPT OF BIOLOGY, DAYTON OH 45469-2320.

Wetlands are some of the most productive and biologically diverse ecological systems in the Midwest, with many in Ohio destroyed for anthropogenic uses. However, there have been recent restoration efforts. Understanding successional dynamics of plants and animals is needed to monitor restoration projects. Aquatic macroinvertebrates are important components of wetland food webs and secondary production (e.g., food for waterfowl). Bimonthly, qualitative benthic and water column hand collections were taken from May - October 1998 in order to establish a baseline inventory of aquatic macroinvertebrates from relatively natural and restored wetlands of the Beavercreek Watershed. It is hypothesized that natural wetlands will have a more diverse macroinvertebrate faunal assemblage. Preliminary data, pooled from both wetland types, revealed at least four phyla and 19 families. For the first month of data, the natural wetland appears more diverse, especially within the Odonata and Coleoptera. Fingernail clams (e.g. *Musculium sp.*) and Ephemeroptera were only collected in the natural and restored sites, respectively. These initial data show that wetlands at different successional stages may contain very distinct aquatic macroinvertebrate assemblages which may be important to the food web and other functional processes of wetlands.

BOARD 5 MICROBIAL ASSESSMENT OF THE LOWER MAHONING RIVER AND CORRELATION WITH POLLUTANTS. ERICA M. RICHARDS AND JOHN D. USIS, YOUNGSTOWN STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, YOUNGSTOWN OH 44555.

The Mahoning River has been utilized for more than a century as an industrial resource, and the effects of this are evident in the high concentration of PAH's and heavy metals in its sediment. We examined sediment bacteria in the lower Mahoning River to correlate concentration of pollutants with bacterial abundance and community structure. We investigated whether bacterial populations were altered in sites with significantly elevated pollutant levels as opposed to less polluted sites. Ohio EPA data were used for sediment pollutant information, and three of the five sites chosen for this study were considered significantly polluted using both the Kelly and Hite, and Ontario guidelines for toxicity. Sampling was performed at five sites along the lower Mahoning River, in triplicate, monthly from June through December 1998. Bacterial abundance was estimated by viable count technique (CFU's) on modified nutrient agar and a total count method using DAPI stain. Average viable counts of aerobes were higher in less polluted sites (mean=1.54×10^7) than in significantly polluted sites (mean=2.23×10^6); however, average viable counts of anaerobes were higher in significantly polluted sites (mean=1.03×10^6) than in less polluted sites (mean=3.10×10^5). These results suggest that aerobes have a larger viable population at less polluted sites, and anaerobes have a larger viable population at significantly polluted sites.

BOARD 6 PREDATOR PREY INTERACTIONS IN STRATIFIED AQUATIC ECOSYSTEMS. HEATHER L. FARRINGTON (LIN WU), MOUNT UNION COLLEGE, 1972 CLARK AVE, ALLIANCE OH 44601.

In the study of aquatic ecosystems, it has been discovered that zooplankton have evolved vertical migration strategies to avoid predation. Light induced migrations have been extensively studied and recreated in laboratory settings; however, limited research has been done on other factors influencing zooplankton distribution in the water column. This study is an attempt to create a stratified water column in the laboratory to examine the influence of temperature gradients on vertical distribution patterns in the presence of predators. It is hypothesized that zooplankton will migrate to the cold hypolimnion of the system to avoid predators that prefer the warmer surface waters of the epilimnion. The study will be conducted in a 30-gallon hexagon aquarium with a cooling coil placed on the substrate to create a hypolimnion of approximately 4 degrees centigrade, while aquarium heaters at the surface will create an epilimnion of approximately 20 degrees centigrade. These temperatures will imitate the summer stratification conditions typical of lakes in temperate regions. The prey items to be used are *Daphnia pulex*, while fish will be used as the predators. The behaviors of prey and predators will be observed separately in the system, then observations will be made of the interactions of these organisms within the system.

BOARD 7 MOVEMENT OF DETRITIVORE AND PRIMARY CONSUMER POPULATIONS IN A RESTORED WETLAND. NICOLE MARIOTTI AND BRUCE A. STEINLY, MIAMI UNIVERSITY, DEPT OF ZOOLOGY, OXFORD OH 45056.

Previously, the studies of restored wetlands have focused on the composition of benthic invertebrate, plant, and water fowl communities. In the midwest, restoration projects have been initiated to provide habitat for endangered vertebrate populations that are dependent on wetland resources. Ultimately, successful restoration of wetlands and colonization by diverse vertebrate communities is dependent on the variety and abundance of primary consumers i.e., shore flies. Wetlands at Miami-Whitewater Park (Hamilton Co., Ohio) were subdivided into habitats that were characterized by vegetation types. This investigation documents spacial changes in shore-fly (Diptera: Ephydridae) richness and abundance in mud-shore habitats that were exposed in late summer. When water levels drop at Miami-Whitewater, saturated mud shore on the margins of pools are colonized by detritivores i.e., *Discocerina obscurella, Paralimna punctipennis* and *Polytrichophora orbitalis*. Continued water level decline exposes new saturated mud shore and the previously saturated habitat dries and this moist mud shore is colonized by grasses. Moist mud-grass habitat is colonized by leaf mining species, *Hydrellia griseola* and *Hydrellia tibialis* and blue-green (Cyanobacteria) consumers, *Hyadina albovenosa, Lytogaster excavata,* and *Scatella stagnalis*, while detritivore abundance decreases. Within 2 weeks, moist habitat dries and shore-fly abundance and richness declines. The change in and movement of shore-fly communities within these naturally exposed habitats suggests that shore-fly species are exploiting new nutrient resources that may sustain relatively abundant shore-fly communities during the late summer months.

BOARD 8 SHORE-FLY (DIPTERA: EPHYDRIDAE) COMMUNITIES IN NEWLY RESTORED WETLANDS. BRUCE A. STEINLY, MIAMI UNIVERSITY, ZOOLOGY DEPT, OXFORD OH 45056.

This investigation is the first study that documents the colonization by shore flies (Diptera: Ephydridae) of newly restored wetlands. Shore flies were collected with a sweep net from wetland habitats at Winton Woods and Miami-Whitewater Parks (Hamilton Co., Ohio) that were characterized by vegetation types. In the midwest, restoration projects have been initiated to provide habitat for endangered vertebrate populations that are dependent on wetland resources. Ultimately, successful restoration of wetlands and colonization by diverse vertebrate communities is dependent on the variety and abundance of primary consumers i.e., shore flies. The purposes of this investigation is to identify shore-fly species that have recolonized newly restored wetlands, document spatial and temporal changes in community structure, and compare communities with diversity and similarity indices. At the Winton Woods localities, *Parydra aquila*, *P. quadrituberculata*, *P. breviceps* and *Notiphila sp.* abundance patterns are similar to communities that are found in mature wetlands. These species were not abundant in newly constructed aquatic habitats at Miami-Whitewater. *Scatella obsoleta*, *Sc. favillacea*, and *Sc. paludum* were collected from the Miami-Whitewater wetland while these species were rare in the Winton Woods wetlands. The differences in abundance, richness, and distribution of shore-flies at Miami-Whitewater and Winton Woods are attributable to water level fluctuations, and differences in plant diversity and the proximity of source populations.

BOARD 9 A SURVEY OF FRESHWATER MUSSELS IN THE CUYAHOGA VALLEY NATIONAL RECREATION AREA. DANIELA C. SMITH, MICHAEL A. GATES, A. RALPH GIBSON, ROBERT A. KREBS, MICHAEL J. S. TEVESZ, B. MICHAEL WALTON, CLEVELAND STATE UNIVERSITY, DEPT OF BIOLOGICAL, GEOLOGICAL, AND ENVIRONMENTAL SCIENCES, CLEVELAND OH 44115.

Native mussels (Mollusca:Bivalvia:Unionidae) are vanishing more rapidly than any other group of animals in the United States. This unfortunate decline of freshwater mussels creates an urgency for an accurate assessment of the biological status of this group within the Cuyahoga River Watershed. Previous studies have identified 9 species of native mussels in the upper reaches of the Cuyahoga, but virtually no information was available on the Unionidae of the lower Cuyahoga and its tributaries. The primary aim of this study was to collect baseline data on the distribution and abundance of freshwater mussels within the Cuyahoga Valley National Recreation Area(CVNRA). Visual surveys of the Cuyahoga River, tributaries, and ponds within the CVNRA began in Summer 1997 and were continued through Fall 1998. Thriving populations of the Giant Floater, *Pyganodon grandis*, and the Lilliput, *Toxolasma parvus*, were found within park boundaries. Unexpectedly, these populations were primarily encountered in ponds and the Ohio Canal, but not in the Cuyahoga River itself. Shell evidence does suggest the presence of several species within the Cuyahoga; however, the biological status of these mussels has yet to be determined. In addition, the survey provided information on the distribution and abundance of fingernail and pea clams, as well as the introduced Asiatic Clam, *Corbicula fluminea*.

BOARD 10 AN EXAMINATION OF SELECT ORDERS OF AQUATIC INSECTS IN THE GREAT MIAMI RIVER IN BUTLER AND HAMILTON COUNTIES, OHIO. MARK A. SCHLUETER[1] AND JAN TRYBULA[2], [1] XAVIER UNIVERSITY OF LOUISIANA, DEPT OF BIOLOGY, 7325 PALMETTO ST, NEW ORLEANS LA 70125, [2] MIAMI UNIVERSITY, DEPT OF ZOOLOGY, OXFORD OH 45056.

In the past three decades, aquatic insects have served as important indicators of environment quality. Although much information and data have been collected on aquatic insects, the majority have come from studies on small streams. In the present study, the diversity and abundance of Ephemeroptera (mayflies), Odonata (damselflies and dragonflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) were examined at four sites on the Great Miami River. Two (River Mile 58 and RM 17) were in wooded forest areas, one (RM 48.5) was in a semi-urban area and one (RM 34) was in an urban area. All four sites had a diverse collection of Ephemeroptera and Trichoptera. The urban site (RM 34) had a low diversity and abundance of Plecoptera and Odonata. The semi-urban site (RM 48.5) had the greatest species diversity. This site had greater amounts of fine sediment due to the presence of a bridge, which may indicate that the benthic substrate of the river may play a more important role than whether the site has a rural or urban location. This study may have important implications about revising our estimates of the environmental impact of dredging in large rivers, both in urban and rural locations.

BOARD 11 SPATIAL DISTRIBUTION OF ZOOPLANKTON IN THE WESTERN BASIN OF LAKE ERIE. MATTHEW W. GOSSES (DR. LIN WU), MOUNT UNION COLLEGE, 1972 CLARK AVE, ALLIANCE OH 44601.

The spatial distribution of zooplankton can be measured by the vertical and horizontal migration of organisms over a twenty-four hour period. Diel vertical migration and horizontal migration occur for various reasons, including predator avoidance, light influences, food supply, temperature, metabolic advantages, or mate seeking. All affect the distribution pattern within the twenty-four hour period. Many studies have demonstrated three basic vertical patterns, nocturnal, twilight, and reversed migration in zooplankton species. But few examine horizontal variation in zooplankton distribution. In this study, both vertical and horizontal distributions of zooplankton were studied in western Lake Erie. Zooplankton samples were taken using a S-P trap near shoreline and at a point offshore, and at three different depths vertically at 1m, 3m, and 5m. The shoreline sample was taken from just below the surface. The zooplankton samples were taken every four hours for a twenty-four hour period. Samples will be identified and enumerated. Results will be discussed in relation to the current changes (e.g., increased water density and inshore macrophytes) in Lake Erie.

BOARD 12 ALTERNATIVE PATTERNS OF SPACE USE IN MALE PRAIRIE VOLES (*MICROTUS OCHROGASTER*) SARAH A. MCCORMACK, MICHAEL G. TOPPING, JERRY O. WOLFF AND NANCY G. SOLOMON, MIAMI UNIVERSITY, DEPT OF ZOOLOGY, OXFORD OH 45056.

Males of several species exhibit alternative tactics to obtain mates. Using mark and recapture live tapping in eight 0.1 enclosures, we identified two alternative patterns of space use by prairie voles (*Microtus ochrogaster*). Residents showed nest fidelity whereas wanderers were captured at several nests. Each month (June - September) consisted of three weeks of trapping at burrows followed by one week of grid trapping. From these data we calculated home range size and percentage overlap of all individuals by enclosure and month. We compared overlap of wanderer and resident males with females and males of both classes. Wanderer males had significantly greater overlap with wanderer females throughout the study season and with resident females in September than did resident males. Similarly, wanderer males always had significantly greater overlap with other male wanderers and with resident males in August and September. We suggest that wandering may be a strategy to gain access to multiple mates. Benefits of increased contact with potential mates are countered by increasing the chance of competitive interactions with other males.

BOARD 13 IS AGE DIFFERENCE BETWEEN MOTHERS AND DAUGHTERS A DETERMINANT OF DOMINANCE INTERACTIONS IN PINE VOLES? ANGELA V. OLSON AND NANCY G. SOLOMON, MIAMI UNIVERSITY, DEPT OF ZOOLOGY, OXFORD OH 45056.

In many mammalian cooperative breeders, only one female typically breeds in each family and daughters are reproductively suppressed. In some species, behavioral interactions between the mother and her daughter suppress the daughter's reproduction. The frequency of these dominance interactions may vary according to the age difference between the mother and daughter. The purpose of this experiment is to identify specific behaviors involved in these dominance interactions in pine voles (*Microtus pinetorum*) and determine if the behavioral interactions vary with the age difference between mother and daughter. Behavioral observations were conducted on animals in which the daughter was 2 months of age and the mother was greater than 12 months or less than 10 months of age. Observations of each family took place within a week on days 1, 3, 4 and 7 at approximately 2100 hours under red lighting. Preliminary analysis indicates that older mothers pass and tug on their daughters 6 and 10 times more frequently than younger mothers do. Lack of reproductive suppression in daughters of younger mothers may be due to low levels of tugging and passing between mother and daughter.

BOARD 14 THE EFFECTS OF TIRE POSITION ON OVIPOSITION SURFACE USED BY MOSQUITOES. JON SCHWEID, SCOTT ULRICH, AND BRUCE A. STEINLY, MIAMI UNIVERSITY, DEPT OF ZOOLOGY, OXFORD OH 45056.

In most cases, discarded tires are stored in a horizontal position. Storage of tires in the vertical position reduces the amount of oviposition surface. The effects of tire orientation on oviposition surface area that is available to mosquitoes is investigated. Direct measurement of casts of tire cross-sections are used to calculate differences in the oviposition surface within vertically and horizontally stored tires. Oviposition surface was calculated for tires that were 25%, 50%, 75%, and 100% full. A comparison of horizontally and vertically oriented tire casings suggests that oviposition surface increases by 40% in horizontally stored discarded casings. Additionally, oviposition surface increases in horizontally stored tire casings when the water level declines. Tire dumps near cities are the source of large mosquito populations. This investigation suggests that mosquito oviposition in tires could be reduced by storing tires vertically. Presumably, the management of tire orientation would reduce dependence on pesticide control measures.

BOARD 15 THE EFFECTS OF METHOPRENE AND ITS DECOMPOSITION PRODUCTS ON METABOLIC RATE AND HINDLIMB DEVELOPMENT IN *XENOPUS LAEVIS*. MICHAEL J. POKABLA (BRANDON A. SHEAFOR) MOUNT UNION COLLEGE, 1972 CLARK AVE, ALLIANCE OH 44601.

This experiment examines metabolic rates and hind limb formation in *Xenopus laevis* when exposed to the pesticide, methoprene and its decomposition products. Methoprene is widely used as a pesticide in both urban and agricultural settings and functions by mimicking Insect Growth Hormone (IGH). When methoprene is exposed to ultra violet radiation, it breaks down into cis-methoprenic and trans-methoprenic acid, compounds that have been shown to cause developmental deformations in amphibians. Worldwide decreases in amphibian populations and increases in amphibian malformations may be linked to endocrine disrupters such as methoprene. The objectives of this experiment are to determine the effects of methoprene and methoprenic acids on embryological development of hind limbs and on metabolic control throughout development. *Xenopus laevis* embryos will be placed in environments containing no methoprene, methoprene concentrations at reported environmental levels, and relatively high methoprene concentrations. Within each concentration level, one half of the animals will be exposed to environmental levels of UV radiation and one half will not receive UV radiation. Metabolic rates will be determined by measurement of oxygen consumption and carbon dioxide production and will be calculated at embryonic, larval, and adult stages. Hind limb development of experimental animals will be compared to control animals through all stages of development. The results of this experiment may help elucidate if, and to what extent methoprene in the environment contributes to the decline in amphibian populations.

BOARD 16 MALE RED-WINGED BLACKBIRD (*AGELAIUS PHOENICEUS*) VOCAL RESPONSE PATTERNS TO DIGITAL PRESENTATIONS OF VARIOUS PORTIONS OF THE CONSPECIFIC FULL DISPLAY SONGS. ERIC BIENIEK, ROBERT BEARFIELD, JANACINA KERR, CARLA MCALEVY, CHRISTINA BEAM, AND GRANT MCLAREN, EDINBORO UNIVERSITY OF PENNSYLVANIA, DEPT OF PSYCHOLOGY, EDINBORO PA 16444.

The purpose of the present study was to determine whether or not different portions of the male red-winged blackbird display song transmit different types of information used for species and individual recognition. Twenty-four free-living adult male red-winged blackbirds were observed in this study. All birds were observed on their wetland territories in Northwestern Pennsylvania during the months of May and June, 1998. Female red-wings were observed in the territory of each male in this study. Previous studies have demonstrated that the second portion of the full display song elicit more robust vocal responses from male red-wings. In the present investigation, we compared the vocal response patterns of territorial males to the full display song or only the initial and terminal portions of the second half of the full display song. In this study, 24 male red-wings were assigned to four groups (six birds in each group). Group 1 was exposed to no signal (control). Group 2 was exposed to the full display song. Group 3 was exposed to only the initial segment of the second half of the display song, while Group 4 was exposed to the terminal segment of the second half of the full display song. Each bird was exposed to a 5 min Preplayback, a 5 min stimulus Playback, and a 5 min Postplayback session for a 15 min continuous observation period. During the 5 min Playback session, stimuli were presented every 10 seconds for a total of 30 presentations. The vocalizations of each male in this study were scored by two observers in the field. A modified tape recorder and an amplified speaker (Saul Mineroff, Inc.) were used to broadcast the signals into the territory of each bird. All stimuli used in this study were digitally converted with a Macintosh 7200/120 computer and Canary software (Cornell Bioacoustic Workstation) to produce signals that were utilized for the playback stimuli. The results indicate only the short terminal portion of the full display song needs to be presented to the males to elicit vocal responses similar to that of the full display song. Therefore, the terminal portion of the full display song, alone, may be capable of transmitting important information such as species and individual recognition. These data clearly suggest that different portions of the display song may be capable of transmitting different forms of information within the species.

Board 17 MALE RED-WINGED BLACKBIRD (*AGELAIUS PHOENICEUS*) VOCAL RESPONSES TO PRESENTATIONS OF A SINGLE SONG COMPARED TO A REPERTOIRE OF SONGS. **Christina Beam, Carrie Kozik, Jan Kerr, Fawn Carpenter, Grant McLaren, Edinboro University of Pennsylvania, Dept of Psychology, Edinboro PA 16444.**

Previous research has indicated that birdsong plays a role in a variety of avian behaviors ranging from territory defense to mating. Traditionally, it has been accepted that certain songs serve one purpose, such as an alarm call. However, most avian species have numerous calls in their repertoire. Unfortunately, the functions of these different calls have not been clearly identified. It seems logical that different calls could transmit different forms of speci-specific information. The objective of this study was to compare the vocal response patterns of male red-winged blackbirds to either a single song-type presentation or a random mixture of three different calls commonly observed in the red-wing repertoire. Fifteen male red-wings were observed in their natural breeding habitats in Northwestern Pennsylvania during May and June of 1998. Female red-wings were present in the territory of each male. In this study, the males were assigned to three groups. The five males in Group 1 served as the control group and received no stimulus during their playback period. The five males in Group 2 were exposed to a digital version of an unfamiliar conspecific intruder's display song. The five males in Group 3 were exposed to a random presentation of three different digital versions of the same male conspecific intruder's calls (a display song, a one-syllable whistle, and a two-syllable whistle). The observation of each bird consisted of a 5 min Pre-playback, a 5 min Playback, and a 5 min Post-playback period, yielding a 15 min continuous observation period. During the playback period the birds in Group 2 were exposed to a display song every 10 secs for 5 mins, totaling 30 presentations. The birds in Group 3 were exposed to one of three random songs every 10 secs for 5 mins, totaling 30 presentations. Each of these three calls were presented 10 times in random order, during the Playback period for Group 3. All stimuli were presented within the territory of each male using a tape recorder and a powered field speaker. All stimuli were digitized with Canary software (Cornell Bioacoustic Workstation) and a Macintosh 7200/120 computer. Vocal responses to the stimuli were recorded by two researchers in the field. Surprisingly, the results of this study indicate that the single display song, presented to Group 2, yielded higher and more consistent vocal response rates from the males when compared to the more complex random array of calls presented to Group 3.

Board 18 INCREASES IN SONG PLAYBACK RATE DECREASE VOCALIZATION RESPONSES OF MALE RED-WING BLACKBIRDS (*AGELAIUS PHOENICEUS*). **Janacina Kerr, Eric Bieniek, Fawn Carpenter, Christina Beam, Grant McLaren, Edinboro University of Pennsylvania, The Bioacoustic Research Training Program, Dept of Psychology, Edinboro PA 16444.**

Previous research suggests that avian vocalizations play an important role in territory defense strategies, species recognition, and individual recognition. Although many calls and songs have been correlated with specific behaviors, it is not known if different portions of a song or call transmit different types of information between members of the same species. In other words, could a specific portion or acoustic feature, of a single song, possess greater informational value than another portion or acoustic feature of the same song or call? The answer to this question remains unclear. The purpose of this quasi-experimental design study was to determine if male red-winged blackbirds would respond to computer-modified increases in the speed of the familiar display song. It was predicted that increases in the speed of the song would decrease vocal response rates of the listener in comparison to normal speed playbacks of the same song. Eighteen free-living, male red-wings were observed in grassland territories in Northwestern Pennsylvania from June to early July, 1998. Female red-wings were observed within the territory of each male. The birds were assigned to three groups (6 birds in each group). Group 1 was not exposed to a signal during the playback , while Group 2 was exposed to the display song of an intruding conspecific at a normal speed. Finally, Group 3 was exposed to a 25% increase in playback speed of the same song. Each bird was exposed to a 15 min observational session including a 5 min Pre-playback, a 5 min stimulus Playback, and a 5 min Post-playback period. During playback periods, stimuli were presented every 10 sec for 5 mins for a total of 30 presentations in all conditions. The stimuli were broadcast into the territory of each bird with a modified cassette recorder and an amplified field speaker (Saul Mineroff Electronics). Two observers recorded the vocalization of each bird during the observational period. The original analog stimulus used in this study was digitized with a Macintosh 7200/120 computer and Canary software (Cornell Bioacoustic Workstation). The results of this study indicate that the increased signal presentation speed decreased, but did not completely eliminate vocal responses of the male red-wing when compared to the normal playback speed of the same signal.

Board 19 REDUCTIONS IN PLAYBACK RATES OF SONG YIELD SYSTEMATIC DECREASES IN VOCAL RESPONSE RATES OF MALE RED-WINGED BLACKBIRDS (*AGELAIUS PHOENICEUS*). **Fawn Carpenter, Eric Bieniek, Christina Beam, Grant McLaren, Edinboro University of Pennsylvania, Dept of Psychology, Edinboro PA 16444.**

Prior research suggests that birdsong plays a role in species recognition, individual recognition, and territory defense. It is unclear which particular acoustic features of any one vocalization are vital to the transmission of information between members of the species. The purpose of this study was to determine if male red-winged blackbirds would respond to computer-modified reductions in the playback speed of a conspecific male intruder's display song. Birds in this study were observed in their wetland territories in Northwestern Pennsylvania through May and June, 1998. During observations, female redwings were observed in the territories of each male. Twenty-four free living male redwings were assigned to four groups (6 in each group). Birds in Group 1 were exposed to no acoustic stimulus during the playback (i.e. control) while the birds in Group 2 were exposed to a normal playback speed of a conspecific intruder's display song. The birds in Group 3 were exposed to a 10% reduction in the playback speed of the intruder's display song, while the birds in Group 4 were exposed to a 40% reduction in the playback speed of the same signal. During the playbacks, the stimuli were presented every 10 secs for 5 mins for a total of 30 presentations. A modified cassette tape recorder and a powered field speaker were used to broadcast the stimuli into the listener's territory (Saul Mineroff Electronics, Inc.). The observation periods for each bird included a 5 min Preplayback period, a 5 min stimulus Playback period, and a 5 min Postplayback period. Thus, each bird was observed for 15 min during which all vocal responses were recorded by two observers. The stimuli used in this study were generated from an original analog song that was digitized using Canary software (Cornell Bioacoustic Workstation) and a Macintosh 7200/120 computer. The results indicate that the males continued to respond to the intruder's song despite considerable reductions in the playback speed. Interestingly, the speed reductions yielded systematic decreases in the vocal responses of the territorial males. These findings suggest that species-specific information was preserved in the highly distorted signals.

Board 20 ORIGIN OF THE FOX COAT COLOR PHENOTYPE IN PRZEWALSKI'S HORSES: A LOOK AT THE MC1-R GENES OF *EQUUS PRZEWALSKII* AND *EQUUS CABALLUS*. **Jennifer M. Harrell (Simon K. Lawrence), Otterbein College, Dept of Life and Earth Sciences, Westerville OH 43081.**

The cause of the fox coat color phenotype in *Equus przewalskii* and *Equus caballus* exists as a missense mutation in the coding region of the MC1-R gene. This region is identical for both species, however, the flanking regions have yet to be identified. The main objective of this research is to determine whether the allele was originally present in the *Equus przewalskii* genome or whether it was recently acquired through hybridization with *Equus caballus*. Restriction fragment length polymorphisms of the flanking regions of MC1-R are being mapped and compared for the wildtype allele and fox allele in both species. Data have been obtained for EcoRI and Hind III and provide implications regarding the origin of the allele. The flanking regions will also be cloned and sequenced for a more detailed analysis.

POSTER SESSION

Pre-College

10:00-11:00 AM

University Center

Board 1 EFFECTS OF SUN BLOCKS IN PREVENTING ULTRAVIOLET MUTAGENESIS. **Daniela H. Tartakoff, 19909 Marchmont Rd, Shaker Heights OH 44122 (Beaumont School).**

The skin is one of the body's organs that is most at risk with regard to cancer. This is because increased exposure to ultraviolet light causes mutations. Can a simple model be developed which illustrates the mutagenic effects of ultraviolet radiation in skin cells? A red strain of *Saccharomyces cerevisiae* (baker's yeast) was grown on nutrient agar in Petri dishes and then used as a model to evaluate mutations. In place of Petri dish lids, Saran Wrap was used, since it did not absorb UV light. The yeast cells were then exposed to 10000 mm/cm2 of ultraviolet light using a germicidal lamp. Once it was clear that the exposure could mutate the cells (by changing their color and decreasing the size of their colonies), *S. cerevisiae* was placed under the germicidal lamp with sun block protection applied to the Saran Wrap. Testing the effectiveness of 3 different sun blocks in

this manner showed that - surprisingly - the SPF (sun protection factor) number itself did not predict a cream's usefulness in protecting the yeast from mutation. By using a spectrophotometer, it became evident that sun blocks containing oxybenzone absorb a wide spectrum of UV light. Those which contain primarily titanium dioxide absorb a more narrow spectrum of ultraviolet light. Thus, sun blocks which contain both oxybenzone and titanium dioxide should be most satisfactory in preventing mutagenesis due to UV light. To conclude, the experiment not only indicated that UV light produces mutations, but also that the active ingredients of a sun block may play a crucial role in its effectiveness.

Board 2 ROAD SALT DISPERSAL INTO THE ENVIRONMENT. **Kyra Sedransk, 15830 S Park Blvd, Shaker Hts. OH 44120 (Hathaway Brown School).**

Soil and water samples were collected at two roadside lakes and a control site to test the hypothesis that the dispersal of road salt depends on the amount of rain and runoff from snow melt. Sampling sites were evenly divided with respect to four factors: shallow/deeper water, short/ moderate distance from road to lake, major/minor road, and quiet/ moving water. At each lake, soil samples were taken at roadside, 8m. from roadside and at lakeside; water was drawn near the shore. Soil samples were leached with distilled water; a conductivity meter measured salinity of leachates and of water samples. Temperature, precipitation and salting journals were kept. The data show that with snow melt or light rainfall, the salt was transported through the soil and eventually into the water. With very heavy rain, transport was direct across the soil surface directly into the lake. In different terrains the transport occurred at different speeds. All but the shallowest sites returned to control levels; salinity remained high away from the roadside 4 months later, indicating incomplete transport through the soil. At the site with no curb, salinity, both soil and water, was 4 to 10 times the levels at other sites. The lack of a curb at this site allows salt to be spread directly on the soil and dumped directly into the water.

Board 3 HOW DOES BRAND OF FILM AND FILM SPEED AFFECT THE GRAIN OF YOUR PICTURES? **Katrina A. Nicholl, 315 S Detroit St, Bellefontaine OH 43311 (Bellefontaine High School).**

Kodak Gold, Kodak Royal Gold, Fuji Super G Plus & Polaroid, films were used in 100, 200, 400ISO's. Kodak Gold 800ISO, Fuji 800ISO, Kodak Royal Gold 1000ISO and Fuji 1600ISO were used to test faster speed films. Still life's of soccer equipment and Looney Tune cartoon models were set up using fabric for the background. Pictures were taken of each display at different exposures. The film was developed at a professional lab and the pictures were labeled so it would be known what brand and speed of film was used for it. The best example was chosen from each speed and brand to print a 5X7 or 8X10 at a professional lab. Then from the same negative an 8X10 section was printed from a 20X24 enlargement, to make the grain more visible. Again, they were labeled as printed so they wouldn't be mixed up. All pictures were then put into file pages and compared, by looking at them with a lupe, to choose the smallest to the largest grain. It was also determined which brand had the largest or smallest grain overall. Kodak Royal Gold 100 had the smallest grain. Kodak Royal Gold was 1st in eight of 10 tests, 1st overall. Fuji Super G Plus was 2nd in 7 of the 10 test 2nd overall, while Kodak Gold was 3rd and Polaroid 4th overall.

Board 4 WIRED WEB WEAVERS. **Lisa M. Siciliano, 16001 Rowena Ave, Maple Hts. OH 44137 (Beaumont School).**

The purpose of this experiment was to observe the effects of different amounts of caffeine on the orb weaving abilities of the spider Argiope trifasciata. I hypothesized that the orb weaving abilities of the spider would be affected. Spider A, the control, was administered only water. Using a solution of coffee, 35 mg of caffeine per 236.58 ml of H2O, I administered the respective concentrations over a three a week period. Spider B- .15 mg/ml, Spider C- .04 mg/ml, Spider D- .009 mg/ml, and Spider E- .002 mg/ml. Spider A made a normal sized orb web. Spider B died three days after the experiment had started; it made the beginnings of an orb web. Spider C made a smaller orb web than Spider A, with fewer radii and spirals, and an unclear free zone. Spider E made no orb web, but made odd circular streaks down the side of the screen. By analyzing data I have obtained and comparing it with previous studies concerning the effects of drugs on spiders, I can conclude that the different amounts of caffeine affected the spiders' mortality rate, production of orb webs, and specifics in web design.

Board 5 GET THE LEAD OUT!: LEAD'S EFFECT ON NEURONAL DIFFERENTIATION. **Melissa M. Blakeley, 25575 Chatworth Dr, Euclid OH 44117 (Beaumont School).**

Lead is a heavy metal encountered by humans in many forms. Human exposure to lead can seriously impair the nervous system. Lead can impact many calcium-dependent processes, one being neuronal differentiation. One way to evaluate neuronal differentiation is to assess adult characteristics, such as neuropeptides. Calcitonin gene-related peptide (CGRP) is one such neuropeptide. In testing the question: How does lead effect neuronal differentiation?, a hypothesis was made that lead inhibits neuronal differentiation, causing impeded CGRP production in developing embryonic rat neurons. To test the hypothesis, a model system of embryonic rat dorsal root ganglion cells in culture was used. Three wells on a plate were prepared with control growth medium NB50, and additional wells had solutions of NB50 with 1 µm, 10 µm, 25 µm, and 50 µm lead acetate, with each concentration set up in 3 wells. The same concentrations of calcium acetate were also made into solutions with NB50 and set up in triplicate wells to demonstrate neuronal contact with a heavy metal. About 2000 embryonic rat neurons on day 14 of their development were added to each well. After 8 days of maintaining the culture, the culture was fixed. Antibodies were attached to the neurons, allowing them to be stained for CGRP. A survival count was taken, and a sampling of 200 neurons from each well was counted to determine CGRP presence. This model proved the hypothesis to be correct. Neurons exposed to the highest lead concentrations, 25 µm and 50 µm, showed both relatively low survival rates and low CGRP percentiles when compared with the controls. This data shows that lead does cause impeded calcitonin gene-related peptide production in developing embryonic rat neurons, and therefore lead inhibits this aspect of neuronal differentiation

Board 6 ATMOSPHERIC INFLUENCES ON RADON LEVELS. **Ryan P. Sullivan, 148 Woodland Way, Chillicothe OH 45601 (Unioto High School).**

Radon, a naturally occurring radioactive gas that forms from the decay of uranium, is the second leading cause of lung cancer in the United States. The goal of this research was to determine if atmospheric conditions influenced radon levels in the home. The hypothesis was "Atmospheric conditions influence ground level radon emissions, resulting in higher radon levels during colder temperatures." A Micro-roentgen Radiation Monitor was used to record indoor radon levels between December 21, 1997 and January 17, 1998. Radiation recordings were taken three times daily at each of three locations around the house. Six different atmospheric conditions were recorded during each observation period. A thermometer and a barometer were used to determine temperature and barometric pressure. Relative humidity and wind readings were taken from an Internet website and personal observations were used to determine cloud cover and moisture. The research indicated a clear linear correlation between barometric pressure and radon levels; however, the research was inconclusive as to any correlation between radon levels and the other variables. The research indicated radon levels inside a house were more likely to be higher during periods of lower barometric pressure. During such periods, radon gases contained in the soil can more readily escape and enter the atmosphere. As barometric pressure in the house drops, there is an increasing gradient for radon to enter the house from the surrounding soil, increasing the potential exposure to dangerous radon gases for residents of the house.

Board 7 ANALYSIS OF INSULATING CAPABILITY OF COMMON MATERIALS FOR USE IN A SLEEPING BAG. **Matthew J. McCauley, 1295 Briar Hill Dr, Akron OH 44333-1121 (Western Reserve Academy).**

The project objective was to find a common material for use in thermal insulation of a sleeping bag that would perform similar to insulation used in high-grade sleeping bags. A good thermal insulator must be capable of suppressing the three modes of heat transfer: conduction, convection and radiation. The effects of moisture and density were also examined. Samples of insulation were obtained for ten common insulators, which had little cost, and three professional sleeping bag insulators. The relative conductivity (K) of each material was calculated by the slope (which represents heat transmitted per unit time). The material with the lowest conductivity would be the best insulator. Of the professional materials tested, 650-down (K= 7.5) was the best performing insulator followed by Quallofil (K= 8.25) and Hollofil (K=8.5). The best common material results were found in 100% polyester artificial snow (K= 8.5). Since the common insulator's relative conductivity is in one case, equal to the professional insulator, total sleeping bag prices could be reduced significantly by using this common material. The effect of moisture was then examined. Results showed that regardless of the insulation, the heat transfer (i.e. K) is increased as moisture is increased, thus the insulation becomes less effective. The effect of density showed that there was an optimum density, at which the insulation is most efficient at reducing heat flow. Beyond this point, conductivity increases with further density increases and as the insulator becomes solid matter, heat transfer becomes the greatest.

Board 8 A COMPARISON OF VARIOUS FLOWERS' COLORS AND FAMILIES THROUGH PAPER CHROMATOGRAPHY AND GEL ELECTROPHORESIS. **Sabrina Jane Zart, 1140 Garman Rd, Akron OH 44313 (Harvey S. Firestone High School).**

The purpose of this experiment was to examine proteins and Rf values of flowers of similar colors from different families. Comparisons were also made of the Rf values and proteins of flowers of the same families but of varying colors. These studies were done through paper chromatography and gel electrophoresis. The hypothesis was that flowers of similar color but from different families would have similar Rf values on paper chromatography and similar band sizes and distances on gels. It was also predicted that flowers of the same families but of different colors would have similar Rf values and band patterns. Three flowers of different families were compared with five different colors: yellow, white, pink, red and purple. Five methods were originally used to extract the pigments of the petals. These included the use of boiling water, ethyl alcohol, sulfuric acid, ether/acetone and a detergent solution. Each extract was tested on paper chromatography and gel electrophoresis to determine which extraction method worked best. Boiling water proved to be best. This method was used to do the actual extractions for the pigment comparison experiment. Each flower's pigments were run on paper chromatography and gel electrophoresis. A solution of hemoglobin and albumin was also run as a molecular weight standard. Paper chromatography results were inconsistent and they showed no major similarities or differences. Very few of the Rf values were similar. The gels were also inconsistent at times, but proved that no major similarities exist between the protein structures of flowers of the same color from different families. None of these bands showed similarities in length or band sizes. The gels showed that flowers of the same type but in various colors have very similar bands and, therefore, are presumed to have similar proteins despite their differences in color. The gels proved that the hypothesis about the existence of similar proteins in flowers of different families but of the same color is incorrect. Each had a completely different band pattern from the other flowers of the same color. However, the hypothesis about the existence of similar proteins in flowers of the same type but of varied colors is correct. The band patterns for each set of these flowers were very similar.

Board 9 CHARACTERIZATION OF INSULIN-LIKE GROWTH FACTOR-I RECEPTOR STAINING IN THE OLFACTORY BULB. **Kristen E. Humbach, 2898 Shaffer Ave, Cincinnati OH 45211 (Seven Hills Upper School).**

Degenerative neurological diseases and injuries to the brain or spinal cord are crippling, paralyzing, debilitating, and presently without any real cure. Damage to the nervous system is irreversible in large part because most neuroblasts fail to survive to maturity. Therefore adult neurons cannot be replaced by the body. It is for this reason that the olfactory epithelium is so interesting. Not only do olfactory neuroblasts survive, but a turnover of cells occurs roughly every month. Hopefully by understanding the different stages in the olfactory receptor neurons' (ORNs) life cycle and knowing the role of growth factors at each stage, we will learn enough to simulate neuroblast survival in other parts of the nervous system. Insulin-like growth factor-I (IGF-I) appears to have a significant role in the survival of immature ORNs. To investigate this role, staining was performed in the olfactory bulb to first localize IGF-I receptor (IGF-IR) and then compare that to staining for the olfactory marker protein (OMP), a mature cell marker. IGF-IR positive fibers were seen primarily in the outermost fiber layer of the bulb with only a few labeled fibers in a subset of glomeruli. This suggests that IGF-I may sustain the immature ORNs' axons until they reach a certain point during their growth into the olfactory bulb. At this point the axons may no longer need IGF-I and therefore they cease expressing IGF-IRs.

Board 10 ISOLATION OF N²-FIXING MICROBES FROM SMALL PONDS IN BOWLING GREEN. **Tian Zhang, 1547 Conneaut Ave, Bowling Green OH 43403 (Bowling Green High School).**

Nitrogen fixation is of fundamental importance in the biosphere. In nature, this occurs via the biological nitrogen fixation reaction. A small, but diverse, group of diazotrophic microorganisms is able to fix atmospheric nitrogen. The main goal of this study is to isolate diazotrophic microorganisms from aquatic samples collected from ponds around Bowling Green State University. Water samples of about 5mL were collected from 4 different locations and incubated in nutrient media lacking a nitrogen source for 7 days. Single colonies from the enriched bacteria were isolated on Burk's nitrogen-free agar plates. By using this strategy, nine different microorganisms were isolated which were proficient in N_2-fixation. Then, the morphology of these isolated microorganisms was investigated by using Scanning Electron Microscopy. This was an initial identification process. Because all N_2-fixing microorganisms have the enzyme system of nitrogenase encoded by the nifH gene, this sequence has been examined. To do this, PCR amplification of corresponding DNA using highly conserved oligonucleotide primers has been utilized and the resulting segments subjected to partial sequence analysis. This will later identify these isolated microorganisms.

Board 11 HOW THE ANGLES AND COMPASS DIRECTION AFFECT THE VOLTAGE OUTPUT OF A SOLAR CELL. **David B. Pryor, 1476 Ardwick Rd, Upper Arlington OH 43220 (Hastings Middle School).**

The purpose of this experiment was to study how the angle and compass direction of a solar cell affect the voltage output. The goal was to find what position had the highest voltage output. The solar panel and digital voltmeter were placed on a turntable. The solar panel was tilted at different angles and rotated to different compass directions. The data was recorded at the following compass directions: north, northeast, east, southeast, south, southwest, west, and northwest. It was also recorded at the following tilts: 0, 10, 20, 30, 40, 50, 60, 70, 80, and 90 degrees at each of the compass directions. The conclusion is that the average voltage output was highest at 1.616 volts at a 40° tilt south and a 30° tilt southwest. Data was recorded in December and January at times between 9:27 A.M. and 3:53 P.M. at a Central Ohio location of 40°, 2 minutes north latitude and 83°, 3 minutes west longitude. The experimental results can be applied when positioning photovoltaics in environmentally friendly solar electric generating facilities or in building energy efficient urban dwellings with roof integrated solar photovoltaics.

Board 12 TISSUE CULTURE OF ASTROPLANT (*BRASSICA RAPA*) EMBRYOS. **Suzie M. Detrick, 164 W Center St, West Mansfield OH 43358 (Benjamin Logan High School).**

Are the suspensors of the embryos, cells that connect the ovule to it's food source thus supplying it with nutrients, of astroplants required for normal development of the embryo? This question is being addressed by culturing astroplant embryos in tissue culture. A laminer flow workstation was disinfected with a foaming laboratory disinfectant. An astroplant pod was then placed in sterile cheesecloth and soaked in 10% Clorox with a drop of Tween 20 for five minutes, 30 seconds in 70% Alcohol, and rinsed in distilled water. It was then transferred to a sterile petri dish and set in the workstation. The outer ovule coat was carefully peeled away. The full, or walking stick, embryo was then placed in astroplant media (half strength Hoglans solution), liquid or solid, and then placed under a fast plant light bank to grow and be observed. To date, the embryos have grown well in the liquid as well as in the solid astroplant media, proving that embryos can indeed grow in the absence of their suspensor. Embryos that were originally grown in the liquid astroplant media were transferred over to solid astroplant media. Most embryos have grown rapidly and have produced flowers, although the number of flowers are less than the number of flowers in a non-sterile environment. This work will continue until the procedures are adequate for culturing of the embryos from the globular stage.

Board 13 GLUTAMATE RELEASE INHIBITORS AS NEUROPROTECTANTS FOR HUNTINGTON'S DISEASE. **Osmond C. Wu, 3945 Lytham Ct, Upper Arlington OH 43220 (Upper Arlington High School).**

Huntington's Disease (HD) is a devastating autosomal dominant neurodegenerative disorder characterized by the relentless development and progression of involuntary movements (chorea), depression, and dementia. While novel interventions must be actively sought, the therapeutic and adverse potential needs to be clearly defined. No effective therapy for HD currently exists. The symptoms of HD are believed to result from degeneration of medium spiny projection neurons within the striatum, a nucleus of the basal ganglia. Evidence suggests that neuronal pathways using the excitatory transmitter glutamate are overly active in HD. This leads to neurodegeneration by a process known as excitotoxicity. The current research has examined the effect of two medications that inhibit glutamate release to alter neuronal injury in a rodent model of HD. Selective injury to medium spiny neurons has been produced by injection of the mitochondrial toxin, malonate (3 µmol/2 µL) into the striatum. Malonate inhibits the enzyme succinate dehydrogenase (complex II) and decreases the synthesis of ATP. Insufficient ATP induces excessive activation of glutamate systems and thereby selective neuronal degeneration similar to that occurring in HD. Riluzole (5 mg/kg and 10 mg/kg) and lamotrigine (25 mg/kg) were administered 2 hours before and 4 hours after malonate treatment. Twenty-four hours after malonate treatment the animals were euthanized. Consecutive coronal sections (25 mm) were gathered through the full extent of the striatum to determine the volume of striatum injured. The higher concentration of riluzole (10 mg/kg) produced more than a 50% reduction in lesion size. Lamotrigine reduced the extent of striatal injury to an even greater degree (>80%) than riluzole. MK-801 (5mg/kg), a drug with proven ability to limit malonate injury, reduced lesion volume by 50%. Variability in the volume of tissue injury and a small sample size prevented a statistically significant result. These results suggest that drugs that inhibit the release of the excitatory neurotransmitter glutamate protect the striatum from the toxicity of malonate. Riluzole and lamotrigine may find application in the treatment of HD.

Board 14 THE BIG PAPER BREAKDOWN. **Lindsay A. Bizzaro, 1345 Heister Rd, Lancaster OH 43130 (Fisher Catholic High School).**

The purpose of this project was to see which kind of paper would disintegrate the quickest, recycled or manufactured. The hypothesis was that recycled paper would disintegrate faster than manufactured paper. The materials used in this project were three equally sized pieces of recycled and manufactured paper, six cups of water, and three different ground areas. The three ground areas tested were grass and soil, biodegraded leaves and grass, and mulch and soil. The method of the project was as follows: the three ground areas were dug down to two inches. A piece of both kinds of paper was placed into each area, then a cup of water was poured over all the paper to moisten the sample. The paper was covered, then checked periodically. Observations were recorded: worms seemed to be breaking up the paper in the grass area and the paper in the mulch area was the least disturbed. At the conclusion of the project the hypothesis was proven wrong. In all areas the manufactured paper disintegrated the quickest. The grass area had no manufactured paper left. The mulch area had the most paper left, most of it being the recycled sample.

Board 15 NO FAT...NO TASTE...NO MORE. **Jon R. Puz, 6259 Gander Rd E, Dayton OH 45424 (Wayne High School).**

The topic chosen for investigation involves a problem many people have-consuming too much fat in their daily diets. In order to help people combat this problem, a decision was made to research and to test different methods of replacing the fat in cookies and in cakes. These methods involved different natural substitutes, such as applesauce, prune butter, corn syrup, and pumpkin. In addition to the substitutes, baking supplies and a baking area were needed. The researcher believed that if high-fat recipes were made fat-free, then these fat-free alternatives would be preferred for reasons other than their fat content (such as superior taste). Thus, in order for any one of these methods to be considered successful, it would have to receive a higher taste tester rating than its full-fat counterpart. In order to test the hypothesis, cookies and cakes were baked, both control and with a varying substitute, and then rated in several areas by taste testers. The data was analyzed, and the results showed that it is possible for fat-free items to be preferred. This was shown through the successful substitution of applesauce in cookies. Since it was possible to make high-fat recipes fat-free, the hypothesis was proven. Furthermore, since no adverse side effects resulted from consuming the baked goods, in some recipes, applesauce should be considered as a safe, effective, and tasty fat substitute.

Board 16 GRAVITROPIC RESPONSE OF ZEA MAYS. **Aricka S. Kerns, 2881 Co. Rd. 5 N, Bellefontaine OH 43311 (Benjamin Logan High School).**

The purpose of this project is to obtain a better understanding of gravitropism, so this knowledge can be used in controlling the growth of plants in space. Corn (*Zea mays*) is used in this study as a model for gravitropic response. Corn has primary roots which show positive gravitropic response. Corn also has secondary roots which grow approximately at a 90° angle to the force of gravity. Kernels of corn were placed in a germinating device that consist of paper towels placed between two trays in a tub of water that was kept perpendicular to the ground. The plants were placed in a bottle chamber that consisted of three two-liter pop bottles. After the tops of three and the bottoms of two were cut off, a plastic lid was used to seal the chamber. Water was kept in the bottom of the chamber to keep it moist. The primary roots of three plants were removed, and three plants were set aside for the use of a control. The plants were observed and the lengths and angles of the secondary roots were recorded two days after placement in the chamber. The plants grown in the absence of a primary root had an average secondary root angle measurement of 16.9°. The plants grown in the presence of a primary root had an average secondary root angle measurement of 36.25°. The preliminary data indicates that the secondary roots of the plants growing in the absence of a primary root showed greater gravitropic response when compared to the secondary roots of the control plants.

Board 17 INTERNAL ELASTIC LAMINA IN RAT ARTERIES: A NEW METHOD OF STAINING. **Shannon Lee M. Bowdren, 827 Fox Valley Ct, Cincinnati OH 45230 (Ursuline Academy).**

The need to study the internal elastic lamina (IEL) of rat arteries requires a proper stain in order to obtain quantitative results. This research was performed so further studies could quantify if breaks in the IEL are a genetically linked trait. With this information, possible control of vascular and arterial diseases could be achieved. Qualifications of an optimal stain would include positive

IEL coloring, large color contrast, and reproducibility. Two stains, Verhoeff, and Toluidine Blue were investigated in this study. Toluidine Blue is not a positive stain when used with a light microscope. However, several experiments were performed which would investigate whether altering the different variables of the Toluidine Blue solution (pH, dilutions, time of staining, solvents) would modify the staining of the IEL. Toluidine Blue appeared as a negative stain with all variable changes performed. As a result, a commonly accepted but less reproducible elastin stain, Verhoeff-Van Guieson, was applied. Because our results revealed that the stain was user-dependent, modified Verhoeff stains were conducted. Verhoeff stains were modified by using a Toluidine Blue counterstain. Based on results from early phases of this study wherein pH and solvents appeared to be the most influential variables affecting the color and affinity of the stain for the tissue, pH and solvent variations were conducted. It was found that a Verhoeff Stain with a Toluidine Blue, acidic, sodium borate based counterstain yielded the desired IEL stain characteristic.

Board 18 DO VARIABLES IN THE METHOD OF COLLECTING SAMPLES AFFECT THE GROWTH OF BACTERIA PRESENT IN BIOFILM? **Erin F. Schlegel, 1900 Atwood Terrace, Coshocton OH 43812 (Coshoction High School).**

The objective of this project was to determine whether variables in collection of water samples (temperature at which the water samples were maintained until inoculation of samples and time frame allowed for bacteria growth on the agar plate) affected the results of bacteria growth. Trypticase soy agar (TSA) was used to determine the plate count of coliphagic bacteria (better indicators of disinfection efficiency than the fecal form due to their resistance) and R2A agar (a low-nutrient media formulated specifically for the cultivation of chlorine stressed organisms in the water samples). A heterotrophic plate count was used to measure changes in water during its treatment and distribution. Twelve water samples were evaluated. They were: Evian bottled water, lake, well, Brita, municipal, shower head water from municipal and well, dental cuspidor, dental handpiece, dental water syringe, dental cast grinder, and ultrasonic cleaning unit. Each plate was allowed to grow for 1 week and checked at 24, 48, and 168 hour increments. Results indicate that the alteration of temperature (heat and cold) and extended periods of time allowed for growth increased quantities of colony forming units (cfu) per milliliter in standard plate counts. An environment suited to the characteristics of a particular kind of bacteria (cold loving-psycrophilic, moderate temperature-mesophilic or heat preferring-thermophilic) was shown to increase the growth of those microorganisms.

Board 19 THE EFFECT OF LIGHT ON A SOLAR PANEL. **Jennifer L. McKimmins, 12020 North St. NE, Utica OH 43080 (Northridge Middle School).**

The purpose of this experiment was to test different light intensities on the functions of a solar panel. It was hypothesized that the stronger the light intensity, the more efficiently the solar panel would function. A 4.5 x 2.5 inch solar panel was hooked up to a carousel model made of K-NEX. The model spun in circles when the solar panel was exposed to light. The sun and 40, 60, 75, and 100 watt light bulbs were all placed in front of the solar panel for one minute. All of the light bulbs were a constant distance from the panel and all light sources were measured with a light meter in foot candles. During the one minute that the panel was exposed to light, the number of revolutions that the model made was counted. This process was repeated three times for each specific light source. The results show that the stronger the light intensity, the faster the model went, and the greater the number of revolutions it made in one minute.

POSTER SESSION

Biological Sciences

2:00-3:00 PM - University Center

Board 1 A UNIQUE C-DNA CLONED FROM RNA EXTRACTS OF NEWT WOUND EPITHELIUM. **Jamie L. Probst (Kenneth P. Klatt), Denison University, Dept of Biology, Granville OH 43023.**

Because the wound epithelium is a necessary feature of the limb regeneration process in the adult red-spotted newt and other salamanders, our lab is interested in the expression of wound epithelium-specific mRNA and proteins. One such newt wound epithelium-specific protein is the newly discovered type I cytokeratin, WE6. We were attempting to clone the 5' end of the WE6 mRNA from wound epithelium RNA extracts when our method of cloning, 5' Rapid Amplification of C-DNA Ends [5' RACE], isolated a 750 base pair cDNA that we call jp4. We have sequenced 395 base pairs of jp4, and found that the entire cDNA is an open reading frame. The 3' end of the cDNA codes for a protein sequence that has not yet been recorded in any data base, but the 5' end of the jp4 cDNA has homology with a portion of the mouse Ephrin B2 precursor, a membrane tyrosine kinase receptor. The peptide coded by the 5' end of jp4 is 35% identical and 56% similar to a 36 amino acid portion of the extracellular domain of Ephrin B2 precursor. We are presently sequencing the remaining 350 nucleotides of the jp4 cDNA, and are employing Reverse Transcriptase-Polymerase Chain Reaction [RT-PCR] to measure the amount of jp4 mRNA present in the normal skin epidermis cells. We are testing the hypothesis that the jp4 mRNA is up-regulated only in the wound epithelium cells.

Board 2 DOES NOGGIN PLAY A ROLE IN LIMB REGENERATION IN *NOTOPTHALAMUS VIRIDESCENS*? **Peter A. Siska, (Kenneth P. Klatt), Denison University, Dept of Biology, Granville OH 43023.**

It is known that functional nerves are necessary for limb regeneration by adult red-spotted newts (*N. viridescens*) and other salamanders. Work in Roy Tassava's lab at Ohio State University supports a model which says that Schwann cells secrete a signal molecule necessary for limb regeneration only if neurons present the Schwann cells with glial growth factor. We are trying to identify possible Schwann cell-produced candidate signal molecules, such as noggin. Noggin is a signal protein that plays its developmental roles in vertebrate embryos by inhibiting the action of BMP-4. Recently, workers in several labs have found that BMP-4 blocks the outgrowth of undifferentiated cells in the embryonic limb bud in the chick. Since undifferentiated cell outgrowth plays a large role in adult limb regeneration, we are testing the idea that noggin is produced by the Schwann cells to allow outgrowth to occur. Presently, we are using the molecular biological method, Reverse Transcriptase-Polymerase Chain Reaction [RT-PCR] to (a) clone the newt noggin mRNA, and (b) measure the amount of newt noggin mRNA produced in the newt regeneration blastema.

Board 3 A MODIFIED METHOD FOR MEASURING GENETIC POLYMORPHISMS WITHIN A POPULATION. **Douglas J. Burks[1], Stacee D. Smith[1], John M Eicher[1], Denise Gordon[2], and Greg Toth[2], [1]Wilmington College, Dept of Biology, 251 Ludovic St, Wilmington OH 45177 and [2]United States Environmental Protection Agency, Ecological Exposure Research Division (MD642), Cincinnati OH 45268.**

RAPD (Randomly Amplified Polymorphic DNA) analysis of the genetic diversity of *Campostoma anonmalum* (stoneroller) populations has been undertaken. RAPD analysis of genetic variation is limited because RAPD polymorphic bands are considered co-dominant markers in that one either sees or does not see an individual DNA band in the DNA fingerprinting of an individual fish. Heterozygous individuals can not be identified nor can loci with multiple alleles. This limits the type of genetic analysis that can be performed on populations. The goal of the present study is to isolate and identify individual locus from polymorphic alleles identified by the RAPD analysis done at the US EPA so that we can develop new PCR/DNA fingerprinting primers that will enable us to identify individuals heterozygous at various loci. We have cloned DNA fragments from polymorphic bands from RAPD gels and have sequenced each clone (40 clones in all). We have developed a set of new primer probes that are loci specific for 19 of the clones. We are now testing the primer sets to see which will enable us to identify individuals who are heterozygous at those loci. We report on the analysis of 5 of the primer sets tested. A number of the primer sets appear to identify heterozygous individuals. Those primer sets will be used to assess genetic variation in stoneroller populations using PCR. We call this approach of developing primers to study heterozygosity at specific random loci SCALPs analysis (Sequence Characterized Anonymous Length Polymorphisms).

Board 4 POPULATION VARIATION IN ANTI-PREDATOR BEHAVIOR IN TRINIDADIAN GUPPIES (*POECILIA RETICULATA*). **Kelly C. Lotts, Denison University, Slayter Box 1430, Granville OH 43023.**

Population variation in anti-predator behavior in fishes has been studied extensively. In particular, alarm reaction studies with members of the fish superorder Ostariophysi have been completed in order to examine population differences in response to alarm substance. In this study, populations of wild Trinidadian guppies (*Poecilia reticulata*) from two predation regimes were used to study population variation in alarm substance and novel predator odor recognition. Fish from high and low predation streams were individually exposed to alarm substance and to a novel predator odor in separate trials. Anti-predator responses of the fish were recorded and compared to determine if guppies from different predation regimes respond differently to the presence of alarm substance or a novel predator odor. Results of these trials will shed light on the role of experience and environment on guppy anti-predator behavior.

Board 5 DISTRIBUTION OF STATE-LISTED RARE AND ENDANGERED PLANTS OF THE OAK OPENINGS REGION OF OHIO. **Timothy L. Walters, University of Toledo, Dept of Biology, Toledo OH 43606.**

The Oak Openings Region is a sand belt that extends through parts of northwestern Ohio and southeastern Michigan. The region is a patchwork of oak barrens, oak openings, dry and wet sand prairies and oak forests. Presently, 154 species of plants are listed by the state of Ohio as potentially threatened, threatened or endangered are found in the oak openings region. These species comprise 30 percent of the rare, native plants found in Ohio. Thus, this region has more rare and endangered species than anywhere else in Ohio. Thirty-three species are solely found in the Oak Openings region. This survey identifies the distribution of the 154 species by their presence in each of the eight preserves of the region. It also identifies which species are still not found on protected lands. The preserves surveyed are Irwin Prairie and Lou Campbell State Nature Preserves, The Nature Conservancy's Kitty Todd Preserve, Maumee State Forest, Oak Openings Preserve Metropark, Secor Preserve Metropark, Wildwood Metropark and the University of Toledo's Stranahan Arboretum. As part of the effort to save this region, a complete survey documenting important plant species will help guide protection efforts.

Board 6 CORRELATION OF THE INDEX OF BIOTIC INTEGRITY (IBI) WITH COMPONENTS OF THE IBI FOR CLEAR CREEK IN HOCKING AND FAIRFIELD COUNTIES, OHIO. **Megan M. Hysell (Michael A. Hoggarth), Otterbein College, Dept of Life and Earth Sciences, Westerville OH 43081.**

Clear Creek in its upper and middle reaches is impacted by agricultural and urban land use practice while the lower reaches of the creek include some of the most scenic stream valleys in southeast Ohio. This stream supports 37 species of fish and its watershed drains three ecoregions; Eastern Cornbelt Plain, Erie Ontario Lake Plain, and Western Allegheny Plateau. The intent of this study was to examine the fish communities at seven sites on Clear Creek to determine which components of the IBI best predict this biological index. Linear regression and correlation

analyses were used. Selected components of the IBI, as well as combined components of the IBI, and numbers of individuals of selected species were examined as the dependent variable. A second objective was to determine if seining alone would produce fish population data sufficient to predict EPA IBI scores. Similar analyses were calculated. Preliminary analysis of data suggests an inverse relationship between IBI and numbers of white suckers and a direct relationship between IBI and number of darters, sculpins and madtoms within Clear Creek.

BOARD 7 FLORA AND LAND USE HISTORY OF THE DENISON UNIVERSITY BIOLOGICAL RESERVE (LICKING COUNTY, OHIO). **KARA E. MILLER, (JULIANA C. MULROY), DENISON UNIVERSITY, DEPT OF BIOLOGY, GRANVILLE OH 43023.**

The goals of this research are to develop a comprehensive species list (flora) of angiosperms at the Denison University Biological Reserve (DUBR; Licking County, Ohio) and to summarize for each section the known land use history. The DUBR contains mixed mesophytic woodlands and successional fields; portions have been used as cropland, pasture, orchard, pine plantation, quarry, and landfill. A master list of expected plant species was developed using two existing county species lists. Comparison of the master list to specimens revealed gaps in the DUBR collections (held at DEN and DUBR), which were partially filled by collecting plants from May 11 to September 17, 1998. Land use histories will be compiled from archival information including aerial photographs, interviews, and legal documents. Additional examination of existing plant collections will target taxa in need of further research and documentation. The species checklist and land use history of the DUBR will provide a framework for future ecological and taxonomic research projects.

BOARD 8 PHOTOSYNTHETIC RESPONSES OF HERBACEOUS SPECIES TO SIMULATED SUNFLECK REGIMES ACROSS THREE LAND-USE LEGACIES. **MATT D. WODKOWSKI, MOUNT UNION COLLEGE, 1972 CLARK AVE, ALLIANCE OH 44601.**

Twenty to 80 percent of the light energy that reaches the forest floor comes in the form of short bursts of high intensity light called sunflecks. The occurrence of sunflecks varies spatially and temporally, thereby creating a dynamic photosynthetic environment. It is possible that differing microenvironmental factors caused by different land-use histories could have an effect on dynamic photosynthetic response. The impact of sunflecks on photosynthesis of herbaceous species was measured at sites with three different prior land-uses (plowed , pasture , woodlot). One plant from each of the three herb species, *Aralia nudicaulis*, *Clintonia borealis*, and *Medeola virginiana*, was selected per site and measurements were taken at each site on three separate days, creating three viable, replicate data sets per plant. The sunfleck regime that was the focus of this study consisted of five, 2 minute 500 µmol bursts separated by 2 minute, 25 µmol intervals. This regime was repeated under three, different constant CO_2 concentrations that reflected a normal range found in the natural environment: 350, 400 and 450 ppm. From these measurements, relative light use efficiency, maximum assimilation, and assimilation per burst were statistically analyzed for differences between sites. At 450 and 350 ppm, the pasture site had the greatest mean maximum assimilation, followed by the plowed site, then the woodlot site. At 450 and 400 ppm, the woodlot site had the greatest relative light use efficiency, followed by the pasture site, then the plowed site For all CO_2 concentrations, the greatest mean assimilation per burst was found at the pasture site, followed by the plowed site, then the woodlot site. Similarly, the overall mean assimilation per burst for each site decreased with decreasing CO_2 concentrations.

BOARD 9 SULFUR NUTRITION EFFECTS ON PHOTOSYNTHETIC EFFICIENCY AND PHOTOINHIBITION AS A FUNCTION OF LEAF DEVELOPMENTAL AGE IN COMMON BEAN. **DENNIS J. HARNEY AND ALFREDO J. HUERTA, MIAMI UNIVERSITY, BOTANY DEPT, OXFORD OH 45056.**

Sulfur deficiency is known to decrease photosynthetic efficiency yet this has not been studied with respect to leaf developmental age. We monitored quantum requirement (QR) and photoinhibition recovery in *Phaseolus vulgaris* var. Bush plants grown in vermiculite in a growth chamber using half-strength Hoagland's nutrient solution at normal S (1.0 mM), low S (0.1mM), and zero added S. Leaf age was determined by Plastochron Index (PI). The QR (measured by galvanic O_2 electrode) of the 1st trifoliate leaf (PI=1.5) showed no difference between normal S (15.2 ± 1.5), low S (15.1 ± 0.1), and zero S (15.6 ± 1.1). The QR of the 2nd trifoliate leaf (PI=2.5) was significantly higher for the zero S (19.2 ± 1.4) than for the low S (16.2 ± 0.8) and normal S (17.1 ± 0.6). Photoinhibition (1700 µmol m^{-2} s^{-1} for 2 hours) severely affected the photochemical yield (measured by modulated fluorescence kinetics) of the 2nd trifoliate leaf of zero S (0.19) compared to low S (0.39) and normal S (0.49). Recovery of photochemical yield from photoinhibition was greatly reduced in the 2nd trifoliate leaf of zero S while low and normal added S showed similar recovery profiles. Sulfur deficiency has little effect in very early leaf developmental age but negatively affects the photosynthetic efficiency and the ability to recover from photoinhibition by the time of full expansion of the second trifoliate.

BOARD 10 LEAF LITTER AND FOREST UNDERSTORY SPECIES OF N. AMERICAN HARVESTMEN AS SCAVENGERS AND PREDATORS IN ROADSIDE, AGRICULTURAL AND URBANIZED ENVIRONMENTS (ARACHNIDA; OPILIONES). **GEORGE E. KLEE, KENT STATE UNIVERSITY-STARK CAMPUS, DEPT OF BIOLOGICAL SCIENCES, 6000 FRANK AVE NW, CANTON OH 44720-7599.**

During a research study of noctural field predation by Opiliones on various arthropods, several species were found to be quite abundant in previously unreported and novel habitats. One unusual type of habitat was the bases of lighted highway signs; 3 harvestman species were collected in significant numbers in this "habitat" during regular nocturnal collections in Stark County in Northeastern Ohio from July to September, 1990, and in other collections in following years at these and similar types of signs. The harvestmen were apparently drawn to these areas by the many insects attracted to the signs. These signs were in some instances 50 meters or more from typical mesic hardwood forest habitats from which the most frequently collected species, *Leiobunum vittatum*, has been previously reported. A laboratory maintainance technique for *L. vittatum* and another opilionid species, *Hadrobunus maculosus*, was developed and will be described.

BOARD 11 CONIDIAL INFECTION OF BLUEBERRY BY *MONILINIA VACCINII-CORYMBOSI*. **SUZU IGARASHI AND JEFFREY S. LEHMAN, OTTERBEIN COLLEGE, WESTERVILLE OH 43081 AND PETER V. OUDEMANS, LAKE OSWEGO RD., RUTGERS UNIVERSITY, CHATSWORTH NJ 08019.**

Conidial infections of blueberry flowers caused by *M. vaccinii-corymbosi*, the causal agent of mummy berry disease, were examined to determine the differences in resistance among host cultivars. Stigmatic surfaces of cultivars Jersey, Bluecrop, and Weymouth were inoculated with dry conidia and pollen. Samples of individual cultivars harvested after 1 day (n=20-41) were stained and examined for hyphal growth. Samples harvested after 8 weeks (n=60-100) were scored for the presence of hyphae in locules. Hyphae grew further in the stylar canals of 'Jersey' and 'Bluecrop' than of 'Weymouth'. At 1 day after inoculation, the mean length of hyphae (± SE) for 'Weymouth', 'Bluecrop', and 'Jersey' were 129 ± 11, 234 ± 41, and 394 ± 72 µm, respectively. At 8 weeks after inoculation, the mean infection frequency (± SE)—number of infected flowers per number of inoculated flowers—for 'Jersey', 'Bluecrop', and 'Weymouth' (0.25 ± 0.04, 0.11 ± 0.03, and 0.04 ± 0.002, respectively) differed significantly. In addition, the mean number of infected locules differed for 'Jersey', 'Bluecrop', and 'Weymouth' (3.9 ± 0.17, 2.1 ± 0.26, and 1.3 ± 0.06 locules per infected fruit, respectively). The results show that cultivars differ in resistance to conidial infections. In addition, infections on 'Weymouth' resulted in partial mummification of the fruit while infections on 'Jersey' resulted in most of the fruit being mummified.

BOARD 12 PHENOLOGICAL DEVELOPMENT OF THE FUNGUS *MONILINIA VACCINII-CORYMBOSI* ON BLUEBERRY. **JEFFREY S. LEHMAN, OTTERBEIN COLLEGE, DEPT OF LIFE SCIENCES, WESTERVILLE OH 43081 AND PETER V. OUDEMANS, RUTGERS BLUEBERRY & CRANBERRY RESEARCH STATION, CHATSWORTH NJ 08019.**

The degree of developmental synchrony of a fungal plant pathogen and its host can influence fungal reproductive fitness. Our objective is to quantify variation in the development of the mummy berry fungus (*Monilinia vaccinii-corymbosi*) on blueberry cultivars. Eight fungal populations collected in New Jersey were assessed for variation in development of apothecia (i.e., fungal sporulating structures). Development and sporulation data were used to predict the duration and pattern of sporulation for the eight fungal populations. Heritability of fungal development was also calculated by partitioning phenotypic variation into genetic and nongenetic components and by analyzing parent-offspring regressions. Mean development times for the eight populations differed significantly and ranged from 35 to 55 days. In general, fungal populations collected from early cultivars developed sooner than populations collected from late cultivars. The estimates of heritability of fungal development ranged from 0.31 to 0.79 and indicated that fungal phenology is selectable and may be altered by the timing of host development. We conclude that *M. vaccinii-corymbosi* populations exhibit significantly different phenologies that influence fungal fitness on early and late blueberry cultivars.

BOARD 13 SLOW-GROWING HETEROTROPHIC PIGMENTED BACTERIA AS AN INDICATOR OF WATER QUALITY IN POTABLE WATER SAMPLES. **LAURA J. FRYBACK (DR. LAURA TUHELA-REUNING), OHIO WESLEYAN UNIVERSITY, HWCC BOX 1437, DELAWARE OH 43015.**

The occurrence of pigmented bacteria in heterotrophic plate counts of treated drinking water generally goes unnoticed because most of these organisms grow slowly and require a longer incubation period than the standard 48 hours. Although not considered primary pathogens, strains of pigmented bacteria have been shown to be hazardous to human health. Their presence in recirculating, chilled drinking fountain water can indicate poor water quality. This study focused on drinking water samples from eight different drinking fountains located in five different buildings on Ohio Wesleyan's campus. These fountains differ in usage, age, and placement along the water distribution route. The water quality was determined by taking weekly samples from each fountain, measuring the free chlorine residual from each sample, and plating the water onto R2A medium. After seven days of incubation, the total number of bacterial colonies from each sample was recorded, as well as the total number from each pigment. Age and usage of fountains appeared to be factors influencing water quality, as the older and less used fountains had higher plate counts. As expected, there was also a direct correlation between the amount of free chlorine in the water at the time of sampling and the total number of bacteria contained in the water sample. Fungus growth was noted on plates from certain fountain samples. A preliminary identification of typical pigmented strains is underway, as also is an analysis of the fluctuations of total bacterial counts over the sampling period.

BOARD 14 THE DISTRIBUTION AND DIVERSITY OF 2,4-DICHLOROPHENYOXYACETIC ACID DEGRADING BACTERIA AT THE UNITED STATES AIR FORCE ACADEMY. **SARAH E. PIERSON (MAJOR AL RHODES), PO BOX 3153, USAFA CO 80841.**

Previous investigations have documented that several genera of soil bacteria isolated from agricultural soils can degrade 2,4-dichlorophenyoxyacetic acid (2,4-D) as a sole carbon source. Although 2,4-D is a xenobiotic compound, metabolic pathways are routinely observed in soil isolates. We predicted that the following 2,4-D degrading genera will be found in the soils on the United States Air Force Academy, Colorado: *Achromobacter, Alcaligenes, Arthrobacter, Corynebacterium, Flavobacterium, Pseudomonas*, and *Streptomyces*. These genera are predicted because they are bacteria that have been discovered to degrade 2,4-D. Samples were taken from five areas of the Academy chosen on their probability to contain 2,4-D degrading bacteria. Most

probable numbers of total heterotrophic and 2,4-D degrading bacteria will be measured to determine distribution and population densities. The diversity of 2,4-D degraders will first be determined biochemically using various substrates to determine the identity of the different bacteria. The diversity will be further studied using genetic techniques to compare the plasmids from different isolates that encode the 2,4-D catabolic.

BOARD 15 EDGE EFFECTS ON THE DISTRIBUTION AND ABUNDANCE OF LARVAL LEPIDOPTERA? **JODI M. HAYLETT, DAVID B. MACLEAN, AND COURTENAY N. WILLIS, YOUNGSTOWN STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, YOUNGSTOWN OH 44555.**

The presence of lepidopteran larvae can greatly affect a forest ecosystem. However, larval distribution and abundance within a forest canopy has received little attention. We examined the effects of edge on the distribution and abundance of larval lepidopteran frass in a late-successional, 10 ha forest plot at the Ravenna Army Ammunition Plant in Portage County, Ohio. From July through September, 1998, fallen frass pellets were collected once per week from the dominant tree species, American Beech (*Fagus grandifolia*) and Sugar Maple (*Acer saccharum*), using 1m^2 frass nets. Duplicate nets were oriented randomly beneath each tree and in three areas of the forest: along a road edge, in the interior of the forest, and along the South Fork of Eagle Creek. Frass pellets collected from a total of 120 nets were weighed to the nearest 0.01 g. No significant difference in frass weights was observed either for beech samples (n=60) of for sugar maple samples (n=60) (one-way ANOVA, α=0.05). Currently, we are estimating densities of the most common lepidopteran larvae found on beech and sugar maple trees, based on identifying frass pellets to species. These preliminary results suggest that the presence of edge did not influence the distribution and abundance of lepidopteran frass in the beech-maple forest we studied.

BOARD 16 THE STRUCTURAL DETERMINATION OF THE SESQUITERPENES IN *CALAMINTHIA ASHEI*. **NICOLE D. SMITH (DR. JEFFREY D. WEIDENHAMER, DR. DALE RAY), ASHLAND UNIVERSITY, DEPT OF CHEMISTRY, ASHLAND OH 44805.**

Calamintha ashei is a perennial shrub that is found along Florida's Lake Wales ridge. A study was done to analyze the components of the trichomes which dot the surface of the *Calamintha* leaves. It is believed that the components of the trichomes are involved defending the plant against herbivores. The four principal components of the trichomes all have a molecular weight of 204, indicative of the sesquiterpenes. These sesqiterpenes were unable to be separated chromatographically, suggesting that the compounds are very closely related isomers. However, the proton and carbon resonances are distinct from one another at high fields, suggesting the feasibility of using NMR experiments on the mixture of sesquiterpenes in order to establish their structures. The following methods will be used: proton NMR, carbon NMR, COSY, TOXY, HMBC, HMQC, and hom2dj. The data from these experiments will then be analyzed and the structures of the sesquiterpenes determined.

BOARD 17 SPECTROPHOTOMETRIC INVESTIGATION OF THE DENATURATION OF α-AMYLASE FROM *ASPERGILLUS ORYZAE*. **STEVE N. BARDOS, JR. (LISA UNICO SMITH), EDINBORO UNIVERSITY OF PENNSYLVANIA, CHEMISTRY DEPT, EDINBORO PA 16444.**

The 3-dimensional structure of α-amylase (*A. oryzae*) has been solved by X-ray crystallography. The structure includes three distinct folding domains, A, B, and C. Interestingly, the sequence of the B domain (residues 122-176) is embedded within the sequence of the A domain (residues 1-121 and 177-280). Thus, the C domain (residues 281-478) may be able to denature somewhat independently of the A and B domains, whereas, the loss of structure in A and B is more likely to be interdependent. Each of the domains contains at least one tryptophan residue: A has seven; B has one; and C has two. Thus, even partial denaturation of the protein should produce changes in UV and fluorescence spectra. Spectrophotometric analyses of α-amylase in the presence of increasing concentrations of denaturant are underway. Loss of enzyme activity will provide further evidence of disruption of the structure. Additionally, the effect of occupation of the active site on the stability of the enzyme will be tested. The spectroscopic analyses will be repeated under two other sets of conditions: in the presence of amylase inhibitor; and in the presence of high concentrations of substrate (amylose).

BOARD 18 CONTRIBUTIONS TO AMERICAN PLANT PHYSIOLOGY:JOSEPH C. ARTHUR [1850-1942]. **GRANT M. BARKLEY, KENT STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, 4314 MAHONING AVE NW, WARREN OH 44483-1998.**

The foundation of American plant physiology arose as part of the New Botany movement advanced by Mid-western Botanists during the later half of the 19th Century. The New Botany ushered in an era of expansion in American Botanical Sciences, which changed attitudes and approaches to the study of botany. Along with new attitudes, new laboratories were being built. During the 1870's and 1880's, the funding of Agricultural Experiment Stations were a substantial boost to botanical study. During this period a number of Midwestern Botanists promoted the importance of vegetable or plant physiology, as a discipline separate from taxonomic or morphological botany. Joseph C. Arthur, Charles R. Barnes, and John M. Coulter as editors of the *Botanical Gazette* actively encouraged the study of plant physiology. Arthur, known for his designs of physiological equipment, produced equipment for sale and published scale drawings in the *Botanical Gazette*. He was motivated in this work especially to promote .... the study of vegetable physiology and to enable American laboratories to have apparattus .... without the necessity of importing high priced pieces from Germany.

POSTER SESSION
EARTH & SPACE; ENVIRONMENTAL; PHYSICAL
3:00 - 4:00 PM
UNIVERSITY CENTER

BOARD 1 THE FUNCTION, POLICY, AND POTENTIAL OF AN URBAN ENVIRONMENT: JACKSON ROTARY PARK. **LAURA DEYOUNG ARNOLD AND CHARLES FREDERICK, DAVEY RESOURCE GROUP, 1500 N MANTUA ST, KENT OH 44240 AND REBECCA THOMPSON, JACKSON TOWNSHIP OPEN SPACE PRESERVATION COORDINATOR, 5735 WALES AVE NW, JACKSON TOWNSHIP OH 44646.**

The study area for this project was a 57.25-acre site in Jackson Township, Stark County, Ohio. The area was zoned for commercial/ retail use, and had a 6.3-acre stormwater retention basin in the center of the block. The purpose of the study was to evaluate the basin and the surrounding landscape (including vegetation and parking lots) in terms of potential for a new public park. The proposed Jackson Rotary Park can serve as a gathering place for employees of the surrounding workplaces and can be a public amenity in this intensively developed area. The site was investigated using GIS mapping, field assessments, and secondary source information. The results of the data revealed a severely degraded urban environment. The existing vegetation was a homogenous collection of invasive species that provided little transition between the parking lots and the retention basin. Thus, the solution for the design is a physical connection between the function of the site and a new role for public gathering. A re-created meadow and a new trailhead will provide an opportunity for education, recreation and research. Jackson Rotary Park can begin to redefine the terms of public infrastructure and public space. It can show the relationship of spaces and functions and serve as a precedent for other urban and suburban areas.

BOARD 2 A SURVEY OF THE PHYSICOCHEMICAL CHARACTERISTICS OF EAST TWIN BLUE HOLE ON ANDROS ISLAND, BAHAMAS. **KATHRYN A. GOGOLIN, WITTENBERG UNIVERSITY, DEPT OF BIOLOGY, BOX 2276, SPRINGFIELD OH 45501-6100.**

Andros Island, Bahamas, located approximately 220 km southeast of Miami, Florida USA, consists of heavily corroded limestone bedrock and has numerous karst features, such as caves and inland blue holes. These blue holes contain a freshwater lens, a brackish halocline, and a saltwater zone. The objective of this study, conducted 12 May 1998, was to survey the physicochemical characteristics of 63 meter deep East Twin Blue Hole to provide baseline data for future studies. Temperature, pH, nitrate, phosphate, oxygen, salinity, hydrogen sulfide, sulfate, turbidity, and specific conductance were analyzed using YSI probes, a Kemmerer bottle, and several Hach instruments. Temperature remained constant at approximately 25-30°C throughout the blue hole. The pH varied between 7 and 8 from surface to near the substrate. Oxygen concentrations and percent oxygen saturation values were high near the surface in the freshwater lens, decreased in the mixing layer, and became anoxic in the saline zone. Hydrogen sulfide concentrations, inversely correlated with oxygen, were zero at the surface, increased in the mixing layer, and were 5 mg/l or more in the saline zone. Salinity increased from close to zero in the freshwater to approximately 37 ppt at the bottom of the column. Specific conductance started at 1000 µS at the surface and increased to almost 60000 µS near the substrate. Amounts of nitrate and sulfate were near zero through the freshwater lens and increased by depth in the interface and saline lens. Phosphate and turbidity levels were sporadic throughout the blue hole.

BOARD 3 HYDROGEOLOGICAL ANALYSIS AND POLLUTION POTENTIAL OF AQUIFERS, VILLAGE OF WINDHAM, PORTAGE COUNTY, OHIO. **CHAD E. EDGAR AND IRA D. SASOWSKY, UNIVERSITY OF AKRON, DEPT OF GEOLOGY, AKRON OH 44325-4101.**

This investigation characterized the aquifer used by the Village of Windham, located in Portage County, Ohio. The study of this consolidated aquifer (Sharon Conglomerate), buried by glacial material, provides valuable information for determining the pollution potential of a public wellfield in a rural area. Well logs, site surveys, published data, and field observations provided data used to study the aquifer. Regional groundwater flow is eastward. The six wells in the municipal wellfield are characterized by very high specific yields and rapid recovery after removal of pumping stress. Aquifer tests, water level records, and published data were used to determine transmissivity, storativity, and hydraulic conductivity; to construct a flow model; define recharge/ discharge areas, and estimate pollution potential. These parameters were then used to create a Wellhead Protection Area, and to provide an effective plan to protect drinking water systems.

BOARD 4 DEVELOPMENT OF A MODERN CAVE DATABASE FOR THE CAVES OF OHIO. **MATTHEW BEVERSDORF AND HORTON H. HOBBS III, WITTENBERG UNIVERSITY, DEPT OF BIOLOGY, PO BOX 720, SPRINGFIELD OH 45501-0720.**

Members of the Wittenberg University Speleological Society, a chapter of the National Speleological Society, have mapped and studied caves in Ohio for the past two decades. This "grotto" surveyed karst features and recorded baseline data on location, geology, speleogenisis, speleothem formation, flora, fauna, as well as on cave conditions such as temperature, humidity, and aquatic physicochemical parameters. By entering this information into ArcView GIS®, geographical database analyses for the caves of Ohio are possible. With the help of Cave Tools which converts cave survey data entered on COMPASS® program into a readable format in ArcView GIS®, cave maps can be overlain with topographic maps for more visual data analyses. Work has begun on entering these data for over 100 Ohio caves. Once entered, further studies

such as passage orientation, diversity of flora and fauna, and differences between caves of glaciated and unglaciated areas of Ohio can be conducted. If information, such as highway locations, urban proximity, and industrial sites is entered, many environmental studies of anthropogenic impacts can be performed and can aid in the protection and conservation of the karst of Ohio.

BOARD 5 NEW MAP OF INDIANA AND OHIO ECOREGIONS REVISES EARLIER VERSION. **C. SCOTT BROCKMAN, ALAN J. WOODS, TIMOTHY D. GERBER, JAMES M. OMERNIK, WILLIAM D. HOSTETER, AND SANDRA H. AZEVEDO, OHIO GEOLOGICAL SURVEY, 4383 FOUNTAIN SQ DR, COLUMBUS OH 43224.**

Revisions have been made to the Indiana and Ohio portions of the 1995 map of *Ecological units of the eastern United States: First approximation*, published through the U.S. Forest Service at 1:3,500,000 scale. Changes in the Ohio portion of the map resulted from more complete evaluation of several statewide data sets, including medium-scale topographic maps, the map of original natural vegetation of Ohio, STATSGO soil maps, a new preliminary map of Ohio's physiographic regions, and descriptive fish data. To insure continuity in method and style, many from the working group that compiled the Indiana-Ohio portion of the first map contributed to the new one. In Ohio, some boundaries have changed and several new areas have been added. A new region, the Marblehead Drift/Limestone Plain, was recognized within the Huron-Erie Lake Plain; in this region glacial drift is thin, streams flow on bedrock, and scattered carbonate ridges supported distinctive flora. Another new region that has a distinctive physical setting and biota is the series of narrows created by the Chagrin, Cuyahoga, and Grand Rivers as they enter Lake Erie, these are collectively called the Erie Gorges ecoregion. Compilers represented the USEPA, U.S. Forest Service, ODNR, Indiana Dept. of Environmental Management, OEPA, and Natural Resources Conservation Service. The map, *Ecoregions of Indiana and Ohio*, is published by the U.S. Geological Survey at 1:1,500,000 scale in poster format and includes text, tables, and photos.

BOARD 6 NEW STACK-UNIT MAP OF CINCINNATI AREA DEPICTS ENTIRE THICKNESS OF UNCONSOLIDATED DEPOSITS. **C. SCOTT BROCKMAN, RICHARD R. PAVEY, GREGORY A. SCHUMACHER, DOUGLAS L. SHRAKE, E. MAC SWINFORD, AND KIM E. VORBAU, OHIO GEOLOGICAL SURVEY, 4383 FOUNTAIN SQ DR, COLUMBUS OH 43224.**

Earlier maps of the unconsolidated deposits of southwestern Ohio have portrayed geomorphically based units, such as ground and end moraine, and, more recently, material-based units to a depth of 5 feet. Most recently, the Ohio Geological Survey completed a stack-unit map of the surficial geology of the Ohio portion of the Cincinnati and Falmouth 1:100,000-scale quadrangles. The map depicts the "stack" or thickness and stratigraphic sequence of geologic units (materials such as till, gravel, sand, silt, and clay) from the land surface down to and including the uppermost buried bedrock unit. Data for mapping came from county soil surveys, ODOT boring logs, engineering logs, water-well logs, and field data. Individual map-areas enclose dozens of acres to several square miles; each map-area is identified by a stack of designators representing thickness and sequence of materials. The map reveals, for the first time, many regional trends including the stratigraphic limits of the area's massive sand and gravel aquifers, the extent of paleosols, and the relation of drift thickness to landscape. Although identification of landforms was not a primary goal of the mapping, geomorphic trends in erosional areas and buried valleys are apparent, as are the thick-till areas of end moraines. Mapping was partially funded by the U.S. Geological Survey and will benefit environmental scientists and engineers as well as land planners and researchers.

BOARD 7 FIELD WORKSHOP ON TILL FRACTURES AND THEIR ENVIRONMENTAL IMPLICATIONS: RESEARCH AND EDUCATIONAL OUTREACH ON SUBSURFACE FRACTURE FORMATION, WATER FLOW, AND CONTAMINANT TRANSPORT IN OHIO. **JULIE WEATHERINGTON-RICE AND ANN D. CHRISTY, BENNETT & WILLIAMS, ENVIRONMENTAL CONSULTANTS INC., 2700 E. DUBLIN-GRANVILLE RD STE 400, COLUMBUS OH 43231.**

On August 28, 1997, a field workshop on joints and fractures in glacial till was held in London, Ohio. The workshop was coordinated and staffed by geologists, soil scientists, well drillers, and engineers. Over 175 people attended the day long event, representing local, state and federal agencies, colleges and universities, and the private consulting sector. The field day included a series of short plenary presentations and four field stations. The first field station included downhole gammalogging, surface resistivity arrays, and slug tests. The second station included two types of drilling rigs: an angle auger rig and a rotosonic rig. The third site consisted of a series of drilling cores that were described by a glacial geologist, a soil scientist, and a geotechnical engineer, demonstrating the different approaches, terminologies, and classifications that each discipline uses. The final site was a large three tiered pit approximately 11m x 26m and 3.56m deep that was used to demonstrate soil profiles and how they were formed, their relationship to the underlying glacial till deposits and the associated polygonal fracture patterns, and the difference in unsaturated hydraulic conductivity between areas of fractures and areas of no fractures.

BOARD 8 THE FLUORESCENCE OF CALCITE IN THE STERLING HILL ORE DEPOSIT, OGDENSBURG, NEW JERSEY: GEOCHEMICAL IMPLICATIONS. **PATRICIA F. BUIS, NE ILLINOIS UNIVERSITY, EARTH SCIENCE DEPT, CHICAGO IL 60625 AND KENNETH A. LASOTA, ROBERT MORRIS COLLEGE, DEPT OF NATURAL SCIENCES, PITTSBURGH PA 15219.**

The Sterling Hill ore deposit in Ogdensburg, New Jersey is known for its many fluorescent minerals. The mechanism for the fluorescence of most of these minerals involves incorporation of the element manganese into the crystal lattice. The manganese then serves as an activator for the fluorescence. Iron, another ore-related element, may also enter the crystal lattice and act as a quencher for the fluorescence. An investigation of the calcite surrounding the metallic ore body with x-ray diffraction, atomic absorption, and fluorometry revealed that these elements were present in the calcite at various concentrations, aiding or inhibiting observed fluorescence. The x-ray diffraction analysis showed shifts in ideal calcite peak position corresponding the amount of manganese and iron in the mineral; the fluorometer data revealed the presence of both calcite and ore mineral fluorescent peaks whose relative intensities corresponded to degree of observed visible fluorescence within the ore body. The examination of the data revealed a fluorescent halo around the ore deposit which might be used to find similar deposits in the future.

BOARD 9 DETECTION OF ABANDONED COAL MINE USING AN INTEGRATED GEOPHYSICAL METHOD. **A.W. GERHARD KUNZE AND RICHARD SULLIVAN, UNIVERSITY OF AKRON, DEPT OF GEOLOGY, AKRON OH 44325.**

An integrated geophysical survey was undertaken above an abandoned coal mine in Norton Township, Summit County, Ohio, in order to evaluate the capabilities of the electrical resistivity, gravity, and magnetic methods in locating underground cavities. One transect was made over a known abandoned mine, and another was taken in an adjacent area over a suspected extension of the original mine. The survey data were reduced, and analyzed using computer programs RESIXplus for the electrical resistivity data and GM-SYS for the magnetic and gravity data. All 3 methods produced results that confirm the existence of an underground cavity for the transect above the known mine. In addition, the results imply that the mine is flooded, and that the overlying strata are heavily fractured. Both the electrical resistivity and gravity data from the second transect were similar to those of the first transect, indicating that the suspected mine extension does exist. The magnetic data of the second transect, however, failed to identify the mine extension, suggesting that the magnetic method may not be suitable for all types of subsurface cavity detection.

BOARD 10 MODIFICATIONS TO AMENDMENT DISTRIBUTION FOR *IN-SITU* BIOREMEDIATION OF CIS-1,2-DICHLOROETHENE AND VINYL CHLORIDE. **JOSEPH M. WARBURTON, JAMES A. PEEPLES, METCALF & EDDY INC., 2800 CORPORATE EXCHANGE DR STE 250, COLUMBUS OH 43231.**

A shallow glacial outwash aquifer at an industrial site in central Ohio was contaminated with cis-1,2-dichloroethene (cis-1,2-DCE), vinyl chloride (VC), soluble petroleum compounds and residual light non-aqueous phase liquids (LNAPLs). The impacted aquifer had a saturated thickness of twenty-five feet. A recirculating in-situ bioremediation pilot cell was installed which achieved significant reductions in cis-1,2-DCE and VC concentrations. A non-recirculating pilot cell was then constructed, using two injection wells located six feet apart. Amendments were injected into the downgradient injection well, and groundwater extracted from outside the pilot area was injected into the upgradient injection well. A grid of observation wells installed in the new pilot area was monitored for concentrations of the contaminants of concern and the nutrient amendments. Nutrient and groundwater injection methods were varied to optimize the distribution of amendments in the aquifer.

BOARD 11 STATEWIDE UNCONSOLIDATED AQUIFER GIS MAPPING IN OHIO. **PAUL N. SPAHR, MICHAEL P. ANGLE, FRANK L. FUGITT, AND KEN R. PENDLEY, OHIO DEPARTMENT OF NATURAL RESOURCES, DIVISION OF WATER, 1939 FOUNTAIN SQUARE DR BLDG E-1, COLUMBUS OH 43224.**

The Ohio Department of Natural Resources, Division of Water, is in the process of completing a statewide Geographical Information System (GIS) map (coverage) for the unconsolidated aquifers in Ohio. The mapping process began in January 1997 and is scheduled for completion in March 2000. Prior to the initiation of this project, the State of Ohio did not have a statewide unconsolidated aquifer map. The goal of the project is to identify unconsolidated aquifer boundaries, quantify aquifer yields, develop a nomenclature system, designate hydrogeologic settings and delineate aquifer thickness. An interpretation of well logs and existing county water-resource maps are used in mapping 7.5 minute maps. These maps are digitized and then combined into 30x60 minute coverages. The 30x60 minute coverages are joined to make a state coverage. Individual maps depicting yield (in gallons per minute), materials, hydrogeologic settings, names, and drift thickness are generated for the unconsolidated aquifers of Ohio.

BOARD 12 DEVELOPMENT OF BATHYMETRIC MAPS OF OHIO RESERVOIRS USING SPATIALLY INTERPOLATED GPS DATA. **PAUL N. SPAHR, OHIO DEPARTMENT OF NATURAL RESOURCES, DIVISION OF WATER, 1939 FOUNTAIN SQUARE DR BLDG E-1, COLUMBUS OH 43224, JOSEPH B. MION AND DANIEL W. SOUCIE, DIVISION OF WILDLIFE, INLAND FISHERIES RESEARCH UNIT, 10517 CANAL RD SE, HEBRON OH 43025.**

Bathymetric maps are valuable tools for the assessment of fish habitats, determining reservoir volumes, and estimating siltation rates. Existing bathymetric maps are outdated and lack detail. A new system of mapping has been developed to provide a highly accurate, digital, representation of the reservoir bottom for the inland reservoirs of Ohio. Geographically referenced data are collected using a global positioning system (GPS) receiver and a surveying fathometer. Spatial relationships in the data are examined through variogram modeling. Parameters obtained from variogram models are used as input for a spatial interpolation of the data using Kriging. Estimations from the Kriging process are compared to the original field data to determine the accuracy of the maps.

BOARD 13 AN EXAMINATION OF LAND USE, WATER QUALITY AND THE ECONOMICS OF ATRAZINE IN THE SUGAR CREEK WATERSHED, DELAWARE, MORROW, AND KNOX COUNTIES, OHIO. **CHRISTOPHER A. REICHMAN (MICHAEL A. HOGGARTH AND ALLEN M. PRINDLE), OTTERBEIN COLLEGE, DEPTS OF LIFE AND EARTH SCIENCES & BUSINESS, ACCOUNTING AND ECONOMICS, WESTERVILLE OH 43081.**

Sugar Creek watershed is a sub-basin of the Big Walnut Creek watershed, which drains into Hoover Reservoir and supplies drinking water to more than 500,000 people in central Ohio. The herbicide atrazine is used to control annual broadleaf and weed species in corn fields dominant in both watersheds. US EPA regulates this class "C" carcinogen compound to less than 3 µg/L in drinking water. The biological objective was to evaluate species diversity in the watershed using the Ohio Department of Natural Resources' Stream Quality Monitoring method. Another aspect was to quantify the application of atrazine and compare concentrations to the creek and receiving reservoir. Total atrazine application was calculated as a function of total corn acres minus corn acres in a buy down program designed to replace atrazine, plus any corn acres where atrazine was not applied outside this program, times the label rate of atrazine application per acre. It was found that the invertebrate community in Sugar Creek was dominated by species resistant to stressed habitat conditions. It is not anticipated that invertebrate diversity will change as a function of a shift in herbicide use. The study also examined costs associated with application and removal of atrazine. Cumulative atrazine concentrations in Sugar Creek were 92.6 µg/L in 1997 and 11.1 µg/L in 1998. The buy down program resulted in approximately 500 acres where atrazine was not applied at an incentive cost of $10 per acre. It is suggested that consumer's cost of removing atrazine and producer's costs of reducing atrazine use should be balanced.

BOARD 14 ECONOMIC IMPACT ON ENVIRONMENTAL REGULATION OF SOCIALLY RESPONSIBLE INVESTING IN SUITABLE MUTUAL FUNDS. **FREDERICK J. KLUTH, 1060 DELEONE DR, KENT OH 44240-2026.**

The environmental cost of industrial and social activity is often considered greater than the economic cost. In an effort to balance this cost some have turned to socially responsible investing (SRI) to encourage industrial sensitivity to environmental issues. Mutual funds have been set up that use environmental and other social screens to pick their investments. To test the impact of this type of investing I gathered names of such funds and located 10 of them in the Morningstar reports, a periodic report of economic statistics on almost 2000 such funds. I then used a random number generator to select ten funds which did not use social screens. I developed a computer program to evaluate the means, standard deviation, and significance of the mean using the t test for various statistics published in the Morningstar reports. I was able to find significant differences between the two groups of funds in the data for 1997. I found the yield on the SRI group to be lower but the total return to be higher. The average total assets of the SRI group was about one third of the other group. With these returns SRI investing has the potential for impact, but their minuscule size compared to the total market means that they have a way to go to reach that potential.

BOARD 15 DETECTION O α-TERTHIENYL IN SOIL WITH POLYURETHANE PLUGS. **SAMANTHA M. LADA (DR. JEFFREY D. WEIDENHAMER), ASHLAND UNIVERSITY, 401 COLLEGE AVE, ASHLAND OH 44805.**

Certain plant species exude phytotoxic chemicals into the soil. An example is the exudation of α-terthienyl and other thiophenes by marigold, *Tagetes erecta*. These compounds can then be taken up by other plants, thereby inhibiting growth, or they may be broken down by soil microbes. In order to evaluate the potential of plants such as marigold to inhibit the growth of neighbors by the release of phytotoxins, information is needed about both the amount of compounds in the soil at a given point in time, as well as the rate of release, which will provide a better picture of the total amount of compounds moving through the soil. The use of polyurethane foam (PUF) plugs as materials which can trap α-terthienyl as released is being explored. If successful, the plugs could provide information on flux rates of the compound through the soil. Experiments are being carried out to characterize the adsorption of α-terthienyl by PUF plugs, determine the most effective extraction procedure for the plugs, examine the stability of α-terthienyl on the plugs over time, and study the trapping of α-terthienyl from spiked soil and from soil in which marigolds are being cultivated. For the extraction and stability studies, α-terthienyl is readily quantified by UV-VIS analysis. For the soil studies, HPLC analysis is used.

BOARD 16 DESIGN AND CHALLENGES OF AN ON-SITE WETLANDS MITIGATION PROJECT IN THE URBAN ENVIRONMENT. **KAREN M. WISE, KENNETH J. CHRISTENSEN, MICHAEL D. JOHNSON, AND ELIZABETH L. BUCHANAN, DAVEY RESOURCE GROUP, 1500 N MANTUA ST, KENT OH 44240.**

Approximately 2.32 acres of wetlands were filled in Eastlake, Ohio to construct a residential housing development. In accordance with Section 404 of the Clean Water Act, wetlands mitigation was performed to compensate for these impacts. To satisfy mitigation requirements, existing wetlands were enhanced by excavating a two-acre, deep-water marsh. The wetlands had previously been dominated by *Phragmites australis* (common reed), a non-native nuisance species that thrives in disturbed urban wetlands. The mitigation wetlands were excavated to depths varying between 1.5 and 4 feet. *Nuphar advena* (spatterdock), *Nymphaea odorata* (fragrant water-lily), *Pontederia cordata* (pickerelweed), and *Utricularia vulgaris* (common bladderwort) were planted. Golden shiner (*Notemigonus crysoleucas*) and mud minnow (*Umbra limi*) were introduced in the deep-water wetlands. Bird boxes and a bat house were installed to attract wildlife. Birds, bats, mud minnows, and bladderwort, a carnivorous plant, provide a multi-level control program for larval and adult mosquitoes and nuisance insects. The enhanced wetlands, existing natural wetlands, and upland buffer provide a 10-acre park-like open space within this residential housing project.

BOARD 17 SYNTHESIS, STRUCTURE AND INTERCALATION OF AMORPHOUS MANGANESE DIOXIDE. **DORINDA GORDON, CENTRAL STATE UNIVERSITY, DEPT OF NATURAL SCIENCES & MATHEMATICS, WILBERFORCE OH 45384, JOHN XU, WILLIAM SMYRL AND MIKE MAY, CORROSION RESEARCH CENTER, UNIVERSITY OF MINNESOTA, MINNEAPOLIS MN 55455.**

Increasing the voltage and life of a battery is desirable for applications like portable cell phones and laptop computers. The purpose of this research was to study the effects on the cell voltage by changing the structure of one electrode, i.e., MnO_2, prior to its incorporation into the electrochemical cell. Manganese dioxide was synthesized with $NaMnO_4 \cdot H_2O$ and fumaric acid disodium salt in aqueous solution with a small amount of H_2SO_4. Manganese dioxide particles were formed over a period of several days. The MnO_2 was filtered, freeze dried and heated at different temperatures (room temperature to 600°C). The material was mixed with Teflon, carbon particles and cyclohexane and dried under vacuum for 24 hours. The dried mixture was compressed into a thin sheet from which pellets were punched with a pellet gun. One MnO_2 pellet, lithium perchlorate propylene carbonate solution, a polymer separator and a small strip of lithium were placed into stainless steel cans (coin cells). The coin cell was crimped for sealing. Completed coin cells were run at constant current discharges or by current pulses. The pulsing rate consisted of running the coin cell for 1 minute followed by turning it off for 1 minute. The constant current discharge caused the voltage of the coin cell to range from 4.0 to 1.5 volts. X-ray diffraction and the B.E.T. method (Braunuer-Emmett Teller) showed that as the synthesized MnO_2 was heated at increased temperatures, the material became more crystalline. At the highest temperature (600°C), the surface area of the MnO_2 was small, and did not perform well in coin cells. At a heating temperature of 200°C, MnO_2 had a modest surface area (about 160 m^2/g), and intercalation of lithium was quite promising. This research was funded by the Army Research Office/ Illinois Institute of Technology through the Minority HUB program.

BOARD 18 REACTIVITY OF HEX-1-YNYL TELLUROLATE. **HELENE S. CITEAU, DEAN M. GIOLANDO, UNIVERSITY OF TOLEDO, CHEMISTRY DEPT, 2801 W. BANCROFT, TOLEDO OH 43606.**

Our purpose is the quantitative synthesis and study of a wide variety of alkyl hexynyl tellurium compounds $C_4H_9C{\equiv}CTeR$. The C≡C-Te group is expected to exhibit interesting properties useful for further organic synthetic development similarly to a C≡C-Se group. Alkyl hex-1-ynyl tellurium compounds have been synthesized by alkylation of the lithium hex-1-ynyl tellurolate in tetrahydrofuran with alkyl halides at room temperature. Lithium hex-1-ynyl tellurolate itself was obtained by lithium hydrogen exchange on hex-1-ynyl followed by tellurium insertion inside the lithium-carbon bond. Reaction of the tellurolate with 28 different alkyl halides leads to 14 different products of which 11 have been isolated. This class of molecules is light sensitive, which is common for diorgano tellurium compounds. In every case the only by-product obtained, if any, is the symmetrical dihexynyl tellurium $C_4H_9C{\equiv}CTeC{\equiv}CC_4H_9$. Products are identified by ^{125}Te NMR, thus furnishing additional heteronuclear NMR data.

POSTER SESSION

BIOLOGICAL; MEDICAL; EDUCATION

4:00-5:00 PM

UNIVERSITY CENTER

BOARD 1 SUBTYPE AT2 AND A FETAL MOUSE PEPTIDE RESEMBLING THE HUMAN NA^+/H^+ EXCHANGER. **SHANNON COOPER, DIETER KNOWLE, NARA GAVINI AND LAKSHMI PULAKAT, BOWLING GREEN STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, BOWLING GREEN OH 43403.**

Angiotensin II (Ang II) is a multifunctional peptide that plays an important role in the neuroendocrine control of cardiovascular function and regulation of body fluid homeostasis, and has been implicated as having a critical role in the cardiopathogenesis of diseases such as hypertension and congestive heart failure. While most of the Ang II-induced physiological effects are mediated through the AT1 receptor, the physiological role of the AT2 receptor is unclear. Although the AT2 receptor is a seven transmembrane domain protein, it does not shift to a low-affinity form in response to GTPγS, suggesting that it is not coupled to any 'classical' G proteins. To elucidate the physiological role of the AT2 receptor we have undertaken a genetic approach to identify cellular proteins that directly interact with the AT2 receptor and mediate its signaling. We have screened a 17-day fetal mouse MATCHMAKER cDNA library using the AT2 receptor as 'bait' and have identified an interacting fetal mouse peptide which shares 94% homology with the human Na^+/H^+ exchanger. This fetal peptide sequence has not been submitted to any scientific database as yet. Thus, a) we have identified a novel, direct protein-protein interaction between the AT2 receptor and a fetal mouse peptide that shares high homology with different Na+/H+ exchangers (NHEs) and b) we have identified a new mouse NHE, expressed during fetal development.

BOARD 2 MUTATIONAL ANALYSIS OF CONSERVED AMINO ACIDS IN THE SECOND INTRACELLULAR AND SECOND EXTRACELLULAR LOOPS OF THE AT2 RECEPTOR. **JASON KURFIS, AMHA TADESSE, NARA GAVINI AND LAKSHMI PULAKAT, BOWLING GREEN STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, BOWLING GREEN OH 43403.**

The Angiotensin II (Ang II) is a multifunctional peptide that plays a key role in the neuroendocrine control of cardiovascular function. Ang II has two receptor subtypes, AT1 and AT2. The AT1 mediates all the known physiological functions of Ang II. The physiological role of AT2 is currently unclear. In an attempt to understand the structure-function relationship of the AT2 receptor we have initiated mutational analysis of this receptor. Our previous studies have shown that the amnio acid Lys215, located in the fifth transmembrane domain (5th TMD) of the AT2

receptor is essential for its binding to Ang II. However, replacing Lys215 by Glu or Gln did not affect the affinity of the AT2 receptor to the AT2 receptor-specific ligand CGP42112A, suggesting that the high affinity binding forms of the AT2 receptor to Ang II and CGP42112A are different. The amino acids Arg182 located in the 2nd extracellular loop and Asp141-Arg142-Tyr143 located in the 2nd intracellular loop of the AT2 receptor are conserved in the AT1 receptor. We have performed mutational analysis to identify the role of these residues in determining the binding properties of the AT2 receptor by expressing the wild type and mutated receptors in *Xenopus* oocytes. Our studies showed that replacing the Arg182 by Alanine or Glutamic acid resulted in generating receptors that have lost affinity to ^{125}I-[Sar^1-Ile^8]Ang II, a ligand that binds both AT1 and AT2 receptors and also to ^{125}I-CGP42112A, a ligand that is highly specific to the AT2 receptor. In contrast, replacing Asp141-Arg142-Tyr143 by Gly-Gly-Ala did not affect the affinity of the receptor to either ^{125}I-[Sar^1-Ile^8]Ang II or ^{125}I-CGP42112A. These results suggest that the contributions of Arg182 and Asp141-Arg142-Tyr143 in determining the high-affinity binding form of the AT2 receptor to either ^{125}I-[Sar^1-Ile^8]Ang II or ^{125}I-CGP42112A are similar.

BOARD 3 ANDROGEN MODULATION OF MPP$^+$-INDUCED DOPAMINE RELEASE IN THE CORPUS STRIATUM AND NUCLEUS ACCUMBENS OF MALE RATS. **L. FEDORKOVA, M. ARVIN JR. AND R.E. LEIPHEIMER, YOUNGSTOWN STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, YOUNGSTOWN OH 44555.**

The present experiment investigated the effects of castration on the modulation of acutely stimulated dopamine (DA) release from corpus striatum and nucleus accumbens of male rats by the Parkinsonism-inducing neurotoxin 1-methyl-4-phenylpyridium iodide (MPP$^+$) or potassium (K$^+$ control). The technique of *in vivo* electrochemistry (IVEC-10, Medical Systems, Inc.) was used for real-time recording of the release characteristics of DA-like signals from carbon fiber electrodes stereotactically passed through the corpus striatum and nucleus accumbens in urethane (1.25 g/Kg, ip) anesthetized intact (control) or castrated rats. In intact or castrated animals treated with MPP$^+$, the DA release characteristics were dramatically reduced in both the corpus striatum and nucleus accumbens when compared to those evoked by K$^+$. Results also demonstrated that specific DA release parameters such as the secretion rate ($p<0.0001$) and clearance rate ($p=0.0020$) were markedly suppressed and the T-20-60 decay time ($p=0.0028$) was prolonged in the nucleus accumbens of MPP$^+$-treated castrated rats when compared to the intact groups, but no differences were observed in the corpus striatum of the same comparison groups. Interestingly, these results also revealed that the DA secretion ($p<0.0001$), clearance rate ($p=0.0007$), and T-20-60 decay time ($p=0.0056$) following MPP$^+$ treatment were significantly more reduced in the nucleus accumbens than in the corpus striatum of castrated animals. These results show that castration alters the effects of MPP$^+$ on DA release dynamics, which were more evident in the nucleus accumbens than in the corpus striatum. Therefore, the current study indicates that testosterone may modulate the effectiveness of MPP$^+$-induced neurotoxicity on dopaminergic activity in these brain regions.

BOARD 4 THE EFFECTIVENESS OF THE INFLUENZA VACCINE IN STARK COUNTY DURING THE 1997-1998 FLU SEASON. **J.M. BOYER, SUMMA HEALTH SYSTEM, 525 E MARKET ST, AKRON OH 44309-2090, S.A. WHALEN, S. DEMARZIO, AULTMAN HOSPITAL, CANTON OH AND W. FRANKS, STARK COUNTY HEALTH DEPT, N CANTON OH.**

There were a number of reports, both nationally and in Stark County, from physicians that the 1997-1998 influenza (flu) vaccine was not effective and that many person who received the vaccine came down with influenza. According to the Centers for Disease Control and Prevention (CDC), a lot produced by one company was weak. This lot was withdrawn early and none appeared in Stark County. There was at least one strain of flu that was found during the flu season that was not covered by the vaccine. Serologic data from hospital labs, health department and physician records were reviewed for persons who received the vaccine with the flu. The total number included in the study who received the vaccine was 2280. There were 29 persons who were proven to have the flu by serodiagnosis or virus isolation that received the vaccine. A diagnostic "score card" was used to interview those receiving the vaccine but with no confirmatory lab data. This score card consisted of 10 symptoms highly associated with the flu as compared with a "cold" or other respiratory disease. Each item is weighted and a score of "10" or higher was considered a probable case of flu. Based on phone interview, 103 persons probably had flu. Based on these data, the failure rate of the 1997-1998 flu vaccine, in Stark County was 5.79%. This was significantly less than the failure rate predicted by CDC, 17% to 20%. The 1997-1998 flu vaccine appeared to be highly effective for Stark County.

BOARD 5 THE POSSIBLE ROLE OF POLYMORPHISMS IN THE PROMOTER OF HLA-DM IN THE FUNCTION OF THE DM GENE. **DAVID T. BROWN (SIMON K. LAWRANCE), OTTERBEIN COLLEGE, DEPT OF LIFE AND EARTH SCIENCES, WESTERVILLE OH 43081.**

In the class II antigen pathway, HLA subunits bind with an invariant chain molecule that upon processing in the Golgi complex is reduced to a smaller peptide known as class II-associated invariant chain peptide (CLIP). HLA-DM functions in removing CLIP from the HLA complex, freeing it to bind to foreign peptides in the extracellular matrix. It has been found that polymorphisms in the DM gene could play a role in the pathophysiology of the autoimmune disease rheumatoid arthritis (Pinet 1996). The goal of this study was to determine if polymorphism were present in the promoter region of the HLA-DMA and DMB genes. DNA was isolated from a panel of 10 donors, and the DMA promoter region was amplified by PCR. The forward primer used in the PCR was radiolabelled with α-^{32}P. Polymorphisms were detected using the Bess T-Scan™ (Epicentre). Conditions for the PCR have been optimized and the polymorphism detection procedures are currently being optimized. No genomic DNA samples have yet been examined.

BOARD 6 SEX DETERMINATION BY ISOLATION OF DNA FROM BONE. **JOSHUA N. ROARK, WRIGHT STATE UNIVERSITY, BIOLOGICAL SCIENCES DEPT, DAYTON OH 45435.**

The discovery that DNA can be recovered from bone has initiated new possibilities for the study of nutritional status, infectious diseases, animal domestication, and sociocultural characteristics of a population. While sex determination has been considered relatively easy to determine morphologically with present day tissues, anthropologists have lacked reliable methods of sex determination from damaged or fragile bones. The isolation of chromosomal DNA (cDNA) can provide an important molecular method of sex determination from skeletal remains. This research involved isolation of cDNA from variant past and present day bone samples. The Polymerase Chain Reaction was used in the presence of the SRY gene (sex determining region Y) found in locus Yp11.3. A pair of primers Y1/Y2 which span a 170-bp fragment were used to detect the human Y-chromosome. False-positive and false-negative controls were included for detection of modern contamination and inhibition of the reaction by means of PCR. The analysis of DNA from ancient specimens can provide important tools offering a new molecular method of sex determination that is independent of morphologic preservation. Although technical difficulties and degradation of DNA in bone may limit future studies to samples from the last few ten thousand years; this research has other implications related to possible molecular approaches to morphologic distinction.

BOARD 7 CHARACTERIZATION OF A PHYSICAL INTERACTION BETWEEN THE ANGIOTENSIN II RECEPTOR SUBTYPE AT2 AND THE ERBB3 RECEPTOR, A MEMBER OF EPIDERMAL GROWTH FACTOR RECEPTOR FAMILY. **DIETER KNOWLE, SAMEERA AHMED AND LAKSHMI PULAKAT, BOWLING GREEN STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, BOWLING GREEN OH 43403.**

To identify the proteins that interact and mediate Angiotensin II receptor AT2-specific signaling, a random peptide library was screened by yeast Two-Hybrid assay. A peptide that shared significant homology with the amino acids located between the residues Gly-Xaa-Gly-Xaa-Xaa-Gly721 and Lys742, the residues predicted to be important for ATP binding of the ErbB3 receptor, was identified to be interacting with the AT2 receptor. The interaction between the human ErbB3 receptor and the AT2 receptor was further confirmed using the cytoplasmic domain (amino acids 671-782) of the human ErbB3 receptor. Moreover, studies using mutated versions of the AT2 receptor suggested that the third intracellular loop of the AT2 receptor is essential for its interaction with the ErbB3 receptor. The third intracellular loop of the AT2 receptor is involved in the induction of apoptosis by this receptor. Thus the interaction between the third intracellular loop of the AT2 receptor and the ATP binding domain of the ErbB3 receptor may reflect the existence of cross-talk between these two receptors. Since the AT2 receptor exerts inhibitory effects on cell growth whereas the ErbB3 receptor promotes cell proliferation, the cross-talk between these two receptors may result in significant modulation of the cellular effects induced by these receptors in response to ligand binding. Moreover, since both receptors are expressed during fetal development, we propose that the existence of direct interaction between these two receptors may play a role in the regulation of growth during the initial stages of development.

BOARD 8 *AZOTOBACTER VINELANDII* UW97: ISOLATION AND CHARACTERIZATION OF GENETIC REVERTANTS. **SHI LEI, LAKSHMI PULAKAT, AND NARA GAVINI, BOWLING GREEN STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, BOWLING GREEN OH 43403.**

Biological Nitrogen Fixation is the reduction of atmospheric nitrogen (N_2) to a more usable compound, ammonia (NH_3). This process is carried out by an enzyme called Nitrogenase. It is one of the most intriguing and complex metalloenzymes and is composed of two separate proteins, Fe-protein and MoFe-protein. Recently, it was shown that this strain lacks dinitrogenase reductase activity which results in the synthesis of a FeMo-cofactor deficient apodinitrogenase. Activation of this apodinitrogenase requires the addition of both MgATP and wild-type dinitrogenase reductase to the crude-extracts made from *A. vinelandii* UW97. Here, we report a systematic analysis of an *A. vinelandii* UW97 mutant and show that, the *nifH* gene of *A. vinelandii* UW97 has no deletion in either coding sequence or the surrounding sequences. The specific mutation responsible for the Nif phenotype of *A. vinelandii* UW97 is the substitution of a conserved serine at position 44 of the Fe-protein by a phenylalanine as shown by DNA sequencing. An oligonucleotide site-directed mutagenesis was employed to confirm that the Nif phenotype in *A. vinelandii* UW97 is exclusively due to the substitution of the Fe-protein residue serine 44 by phenylalanine. Furthermore by isolating genetic revertants we show that the Fe-protein of the nitrogenase is very flexible in its conformation and can rearrange itself to be able to participate in nitrogen fixation reactions.

BOARD 9 MITOTIC ACTIVITY OF EMBRYONIC LUNG TISSUE IN VARIOUS SERA. **NICOLE L. TOUSSANT, HEATHER N. SMITH, AND KARL J. ROMSTEDT, CAPITAL UNIVERSITY, BIOLOGY DEPT, 2199 E MAIN ST, COLUMBUS OH 43209.**

Growth medium for animal cell culture is typically supplemented with fetal bovine serum (FBS). This study examines whether chicken serum might be better than FBS for growth of chicken cells. Since the chick serum was not from a fetal source, we also compared it to non-fetal horse serum. Fertilized chicken eggs were obtained from the Ohio State University Poultry Farm in Columbus, Ohio. Lung tissue was excised from embryos after hen's eggs were incubated at 37.5°C for 10-13 days. Cells were dissociated from minced tissue using 0.25% crude trypsin. They were initially grown and passaged in Ham's F-12 media containing 10% FBS. Cells were then cultured in Falcon Primaria 24-well plates using Ham's F-12 medium supplemented with 10% FBS, 10% chick serum (CS), or 10% horse serum (HS). One ml of medium containing 3×10^4 cells was plated into each well. Daily counts of attached cells were obtained from 4 representative wells for each serum type by detaching cells with trypsin-EDTA and counting with a hemacytometer.

The maximal observed density was 29,875 ± 3,515 (SEM) cells/cm^2 on day 5 using FBS. CS-treated medium only had a density of 6,815 1 720 on day 5, but this was 241% greater than the density seen with HS (2000 ± 290). The data suggests that fetal hormones in FBS are important mitogens and that this effect supersedes the presence of a matching donor source for the serum.

Board 10 BIOCHEMICAL MECHANISM OF THE NifM PARTICIPATION IN BIOLOGICAL NITROGEN FIXATION. Nara Gavini, Dieter Knowle, and Lakshmi Pulakat, Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403.

In order to gain insight into the mechanism of the nitrogenase reductase assembly process, we are investigating the role of the NifM protein in conferring stability and activity to the nitrogenase. Our comparison studies indicated that one of the possible functions of the NifM protein is to assist in the proper folding of the nitrogenase reductase by catalyzing the conformational interconversions by the cis/trans isomerization of the peptide bond N-terminal to the proline residues present in this peptide. We have constructed a plasmid that over expresses NifM in *E. coli* and by using standard protocols, we have been able to obtain pure NifM protein. We observed that this recombinant NifM exhibited peptidyl prolyl cis-trans isomerase activity when Succinyl-Ala-Phe-Pro-Phe-4- nitroanilide was used as a substrate. The NifM-proteins from a number of nitrogen fixing organisms show relatively weak homology with the highest homology located in the C-terminal region suggesting that this portion of the protein may be responsible for its function. Initially we have cloned the *nifM* from *Klebsiella pneumoniae* mutants that are defective in the NifM function and subjected them to nucleotide sequence analysis. This analysis served us as a guideline in generating site-directed mutants of *Azotobacter vinelandii nifM*. These results and their implications in the maturation and assembly of this metalloprotein will be discussed.

Board 11 ISOLATION AND CHARACTERIZATION OF THE NifM INDEPENDENT ASSEMBLY MUTANTS IN NITROGENASE REDUCTASE. Beverly Metcalfe, Jana Bostalman, Meredith Porter, Dieter Knowle, Lakshmi Pulakat, and Nara Gavini, Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403.

The *nifH* of *Azotobacter* encodes the enzyme nitrogenase reductase, which is a specific electron donor to the MoFe-protein of nitrogenase. It is about 60kDa molecular weight and a dimer of two identical subunits. Assembly of this dimeric protein requires a participation of the nif-accessory proteins: NifM, NifU and NifS. Recently we have identified the mechanistic role played by the NifM in the assembly of the nitrogenase reductase. Based on this observation, we designed a genetic selection strategy and isolated a series of assembly mutants in the *nifH* after PCR-random mutagenesis. These mutants were further characterized by molecular cloning and nucleotide sequence analysis of the *nifH*. In this analysis we found that the mutations in four of these mutants are confined to the region of the Fe-protein polypeptide where the conserved proline residues are located. This observation is in agreement with an assigned role for 3-proline residues in the nitrogenase reductase primary sequence.

Board 12 STRUCTURE-FUNCTION OF THE AT2 RECEPTOR: ROLE OF THE THIRD INTRACELLULAR LOOP. Lakshmi Pulakat, Jason Dittus, Shannon Cooper, and Nara Gavini, Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403.

Angiotensin II (Ang II) receptor subtypes AT1 and AT2 are shown to exert cellular effects such as activation of Phospholipase A2 and production of arachidonic acid in a synergistic manner. They are also shown to exert opposing effects on the cells since the AT1 receptor activates mitogen activated protein kinases and induce cell proliferation whereas the AT2 receptor activates MAP kinase phosphatase and induce apoptosis. These two receptors share 34% overall homology, but the least homology is in their third intracellular loop (3rd ICL). In an attempt to elucidate the role of the 3rd ICL in determining the similarities and differences in the functions of the AT1 and the AT2 receptors we generated a chimeric receptor in which the 3rd ICL of the AT2 receptor was replaced with that of the AT1 receptor. Ligand binding properties and signaling properties of this receptor were assayed by using *Xenopus* oocyte expression system. Ligand binding studies using [^{125}I-Sar^1-Ile^8] Ang II, showed that the chimeric receptor has lost affinity to this ligand. However, ligand binding studies using 3H-Losartan, an AT1 receptor specific ligand showed that the chimeric receptor has gained affinity to this receptor. Moreover, IP3 levels of the oocytes expressing the chimeric receptor were comparable to the IP3 levels of the oocytes expressing the AT1 receptor suggesting that the chimeric receptors could couple to phospholipase C pathway in response to Ang II. We have shown previously that the nature of the amino acid present in the position 215 located in the fifth transmembrane domain (TMD) of the AT2 receptor plays an important role in determining its affinity to different ligands. Our results from the ligand-binding studies of the chimeric receptor further supports the idea that the structural organization of the region spanning the 5th TMD and the 3rd ICL of the AT2 receptor has an important role in determining the ligand-binding properties of this receptor.

Board 13 A SHUTTLE VECTOR WITH A TARGET GENE FOR MUTAGENESIS ASSAYS IN BOTH BACTERIA AND HUMAN CELLS. Resham Bhattacharya and D. Beck, Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403.

Cisplatin is a potent antitumor agent which mediates its biological activities through its reactions with DNA where it produces specific DNA adducts. The plasmid pBB1 was constructed and carries a target gene for mutagenesis, the supF tRNA gene. The SupF tRNA allows for a selectable phenotype (Lac$^+$) in ES87 cells which are Lac$^-$ because of suppression of the amber mutation in the lacI gene. The LacI protein is then a super-repressor which is not inducible. Position of adducts in the supF gene after exposure of pBB1 DNA to cisplatin was determined by inhibition of DNA replication by cycle sequencing and primer extension assays. The amount of amplified PCR product decreased with increasing doses of cisplatin. Adducts in DNA exposed in vitro to cisplatin were correlated with the mutagenic fate of these adducts when the DNA was replicated in *E. coli* ES87 uninduced and induced for the SOS responses. The nature of mutations were determined by DNA sequence analyses.

Board 14 MOLECULAR CLONNING AND NUCLEOTIDE SEQUENCE ANALYSIS OF THE rfb GENES IN *AZOTOBACTER VINELANDII*. Bryan Hausman, Ryan Schreiner, Lakshmi Pulakat, and Nara Gavini, Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403.

We have located the *rfbF* and the *rfbC* sites adjacent to the previously identified *rfbG* site (Gavini et. al. Biochem. Biophys. Res. Commun. 1997, 240, 153-161) from the non-symbiotic, non-pathogenic soil bacterium *Azotobacter vinelandii*. The *rfbF* open reading frame encodes a putative polypeptide of 256 amino acids. This polypeptide shares a homology of 74% with the RfbF of *Synechocystis* sp. and a 70% homology with the AscA of *Yersinia pseudotuberculosis* which function as α-D-glucose-1-phosphate cytidylyltransferases in the biosynthesis of the O-antigen. The *rfbC* encodes a putative polypeptide of 186 amino acids. It shows strongest homology to the RfbC of *Synechocystis* sp. (64%) and *Salmonella typhimurium* (40%). RfbC functions as a dTDP-4-Dehydrorhamnose 3,5-Epimerase. The genes identified here have a low G+C content (~56%) as compared to the *A. vinelandii* chromosome (~63%) which is characteristic of the *rfb* clusters identified in other bacteria and may be indicative of the acquisition of the *rfb* genes by interspecific gene transfer. Despite the high level of sequence conservation, the organization of the *rfb* genes in *A. vinelandii* deviates from the arrangement of the most thoroughly studied *rfb* gene clusters of Enterobacteriaceae.

Board 15 GENETIC ANALYSIS OF MULTIPLE CHROMOSOMES IN *AZOTOBACTER*. Man Hee Suh, Ekem Efuet, Lakshmi Pulakat and Nara Gavini, Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403.

It was suggested that *Azotobacter vinelandii* cells contain about 80 copies of their chromosome and when foreign genes are introduced into the cell, it took several generations for them to spread to all 80 chromosomes even in the presence of selection. In contrast, the fact that many recessive mutants can be isolated from *A. vinelandii* without the constraints expected for a cell that has 80 copies of its chromosome argued against this organism being highly polyploid. We have investigated the segregation of a kanamycin resistant genetic marker under non-selective conditions in *Azotobacter vinelandii*. Plasmid DNA was used to introduce the kanamycin resistance gene onto the *A. vinelandii* chromosome at the *nifY* locus by homologous recombination. The transformants were identified from non-transformants with the aid of replica plating, and hence the colonies examined for segregation of the genetic marker were never subjected to kanamycin selection. In spite of growing the transformants in the absence of selection pressure, no segregant that lacked the kanamycin resistance gene was scored. In contrast when the *A. vinelandii* cells were made Nif$^-$ by inserting a kanamycin resistance marker gene in the *nifDK* and the cells were selected for kanamycin resistance and Nif$^+$ phenotype, we were able to score colonies that were both kanamycin resistant and Nif$^+$. Thus when the cells were subjected to forced duel selection of the same locus, they behaved as if they carried at least two chromosomes, one carrying the kanamycin resistance marker in the nifDK genes and the other carrying the intact nifDK genes. These analyses suggested that a diploidy can be induced in these cells under selection pressure.

Board 16 ASSEMBLY OF NITROGENASE REDUCTASE. Manisha Narasimhan, Dieter Knowle, Lakshmi Pulakat and Nara Gavini, Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403.

The role of different *nif* genes in the maturation of nitrogenase component proteins was examined by expressing the *nifH* gene of *K. pneumoniae* in an *E. coli* background in combination with different *nif* genes. The *nifH* gene's expression was conducted under anaerobic conditions; and it was observed that its expression in *E. coli* in the absence of the *nifM* gene resulted in the accumulation of low levels of the Fe-protein polypeptide. This Fe-protein had no detectable activity as determined by an *in vitro* C_2H_2-reduction assay. These results suggest that the *nifM* gene product plays a role in conferring activity and some stability to the Fe-protein. Since isolated Fe-protein does not contain any NifM protein, it is unlikely that NifM is a subunit of the Fe-protein complex. Therefore, the role of the NifM protein could be to impart activity and stability to the Fe-protein through some sort of catalytic event. To investigate further, we have isolated mutant nitrogen fixing bacteria that are capable of synthesizing active nitrogenase reductase in the absence of NifM. Further studies on the mutant strain by nucleotide sequence analysis showed that the mutation is in the primary sequence of nitrogenase reductase within the region of proline residues. This study further supports our hypothesis that the NifM exerts its effect on the maturation of nitrogenase reductase through peptidyl-prolyl *cis/trans* isomerase activity.

Board 17 ISOLATION OF MOUSE FETUS PEPTIDES THAT DIRECTLY INTERACT WITH THE ANGIOTENSIN II RECEPTOR AT2. Charles Knight, Tricia Luhn, Shannon Cooper (Lakshmi Pulakat and Nara Gavini), Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403.

Angiotensin II receptor subtype AT2 is a protein with seven transmembrane domains. Although some cellular responses stimulated by this receptor are inactivated by treatment with pertussis toxin, suggesting its possible coupling to a G_i-protein, this receptor does not demonstrate the GTP-γ-S-induced shift to a low affinity form that is characteristic of the G-protein linked receptors. Thus, it is currently unclear which cellular proteins directly interact with the AT2 receptor and aid in its signaling. To identify these as-yet-unknown cellular proteins, we have

employed the Yeast-Two-Hybrid protein-protein interaction assay to screen a 17 day fetal mouse MATCHMAKER cDNA library, using the AT2 receptor as the "bait." In this system, the physical interactions of the AT2 receptor (translationally fused to the GAL4 DNA binding domain) and a fetal mouse peptide (translationally fused to the GAL4 activation domain) are detected by two methods. Interaction between the AT2 and the proper fetal mouse peptide will result in the reassemblage of the GAL4 transcriptional activator complex, which will initiate transcription of the *gal* promoter sequence. The expression host, *S. cerevisiae* strain CG1945 or Y190, has two genes under control of the gal promoter, *lacZ* and *His3*. Protein-protein interactions are detected by the ability of the yeast strain to grow on His-medium and its expression of β-galactosidase activity. We have obtained three DNA fragments encoding the AT2-interacting fetal mouse peptides. Currently, we are performing nucleotide sequencing of these fragments to determine the molecular nature of the AT2 receptor-interacting peptides.

BOARD 18 CAUSES OF INJURY AND DEATH OF WILDLIFE SEEN AT AN URBAN REHABILITATION CENTER. **LAURA HICKMAN (DR. PENNY BERNSTEIN), KENT STATE UNIVERSITY STARK CAMPUS, 6000 FRANK AVE, CANTON OH 44720.**

Wildlife rehabilitation, attempting to save sick or injured wild animals, is a relatively recent undertaking. Concern for wildlife has developed in part because of conflicts between native animals and expanding human populations, whose cars, pets, toxins, and land uses can have dramatic effects on animals and habitat. A rehabilitation internship at Sanders Wildlife Center provided the first author with an opportunity to investigate the impact of a mostly urban human population on local wildlife by studying the cases brought to this facility in the Canton/Massillon area. Using guidelines established by the International Wildlife Rehabilitation Council, we were able to classify 727 cases brought into the facility from January through October 1998: more than 59% of cases involved animals injured or put at risk as a result of human intervention (attacks by cats or dogs, disruption of nesting sites, etc), while only 6% were the result of natural injuries (e.g. bird injured by hawk attack). However, an additional 35% of cases involved instances where human intervention helped the animals.

BOARD 19 DEVELOPING A MEASURE OF PUBLIC UNDERSTANDING OF CLIMATE CHANGE AND WILLINGNESS TO ACT WHEN SCIENCE IS UNCERTAIN. **JEFFREY R. CORNEY, ROSANNE W. FORTNER, JAE-YOUNG LEE & SAMANTHA ROMANELLO, OHIO STATE UNIVERSITY, SCHOOL OF NATURAL RESOURCES, 2021 COFFEY RD, COLUMBUS OH 43210-1085.**

During a ten-week period prior to the Kyoto Conference on Climate Change in 1997, two parallel studies were conducted to begin developing a measure of public understanding of climate change issues and willingness to act on those issues when the science being presented in media portrays varying degrees of certainty. Study I examined media portrayals of global warming and the certainty with which information was reported by assessing the percentage of hedging, used as a rhetorical device, as an indicator of uncertainty. Study II was a telephone survey to assess public knowledge about key topics in global climate change, certainty about that information, trust in media sources, and willingness to take action toward mitigating global warming. Media reports were found to be scarce, and about half of the references to global warming were found to be hedged. More hedging was evident in newspapers than other mainstream print media and national television reports. Economic impacts of climate change were reported with the greatest certainty. The audience (n=139) reported trusting media sources more than 50% of the time. They were fairly knowledgeable and certain about global warming information and appeared to be willing to adopt a range of responsible behaviors considered to be useful in countering global warming. The knowledge/ certainty construct was described as "attitude under uncertainty," and was moderately related to willingness to act ($r=0.400$; $p<0.05$).

BOARD 20 APPLICATION OF A CRITICAL THINKING MODEL TO BIOLOGICAL INSTRUCTION. **JOHN L. FROLA AND DAVID J. STROUP, UNIVERSITY OF AKRON, DEPT OF BIOLOGY, AKRON OH 44325-3908.**

Science teaching, in particular, is devoting more attention to the need for teaching methods and strategies which can develop students' ability to think logically, analyze, and utilize basic concepts to draw conclusions and make predictions. A model using angiosperm seasonal studies was developed. Observations of the shoot apices are described based on an analysis of the theories on shoot apical organization. Measurements and descriptions of apical dome height and width of the species were obtained to serve as a basis for classroom discussions concerning the changes in apical organization over a one year period. Results of these studies were used to prepare a multi-media presentation which allowed students to make observations and generate hypotheses about shoot development. During classroom discussion, fundamental anatomical and morphological questions were generated to be used as the basis for student laboratory projects. This model maintains a balance between teaching information content and enhancing higher order thinking skills.

AQUATIC BIOLOGY
09:00AM SATURDAY, APRIL 24, 1999
MAIN CLASSROOM BLDG. - 101
SUSAN CARTY - PRESIDING

9:00 DISTRIBUTION OF FRESHWATER DINOFLAGELLATES FIRST IDENTIFIED FROM NORTH AMERICA. **SUSAN CARTY, HEIDELBERG COLLEGE, DEPT OF BIOLOGY, TIFFIN OH 44883.**

Relatively few species of freshwater dinoflagellate were first reported from North America, about eight species of armored dinoflagellate and twelve species of unarmored dinoflagellate, of some 300 species world wide. Of the eight species of armored dinoflagellate, five have been reported only from North America (*Peridinium wisconsinense, Sphaerodinium fimbriatum, Thompsodinium intermedium, Woloszynskia reticulata, Peridiniopsis thompsonii*), and one seems to be cosmopolitan (*Peridinium gatunense*). Of the 12 species of unarmored dinoflagellate, many are single reports. The actual distribution of these species may be more extensive than reports would indicate. *Thompsodinium intermedium* is known from three published reports (from Kansas, Cuba, Ohio), but has been found in Texas, New York, and Belize by the author.

9:15 CHARACTERIZATION OF OPEN WATER AND LITTORAL ALGAL COMMUNITIES IN A NEWLY REHABILITATED OHIO WETLAND. **DANA J. FLEISCHMAN, DALE A. CASAMATTA, JOHN R. BEAVER, BSA ENVIRONMENTAL SERVICES INC., 21403 CHAGRIN BLVD STE 101, BEACHWOOD OH 44122.**

Wetlands provide many diverse ecosystem functions such as flood prevention, nutrient retention and removal, as well as providing a habitat to many endangered organisms. In order to manage and protect these unique and declining areas, a need to understand their structure and function is needed. One feature of wetlands is its diverse algal community, which can be used to assess the level of physiological stress to an aquatic system. In order to examine algal community response to perturbation, the algal community of a recently rehabilitated (1995) wetland in Barberton (County), Ohio was sampled. The wetland is divided into two, ca. 2 ha. pools both fed by a 20 ha. quarried lake. Four open water samples (1-2 m depth) and four littoral/epiphytic samples from each pool were collected biweekly from June 2 through August 14. A total of 97 taxa were recorded. Open water samples were dominated by chlorophytes. Cyanophytes were typically the second most abundant algae followed by diatoms and euglenophytes. Chrysophytes, cryptophytes, and dinophytes were never very prevalent, and were absent on several sampling dates. Chlorophytes and cyanophytes were the dominant littoral/epiphytic algae encountered, although the taxa differed from the open water assemblages. Chrysophytes, cryptophytes, and dinophytes were always poorly represented. Species richness of this system was greater than comparable algal communities of constructed, non-impacted, and temporary wetlands in Ohio.

9:30 BENTHIC BACTERIAL PRODUCTION AND PROTOZOAN BACTERIVORY IN THE OLD WOMAN CREEK COASTAL WETLAND. **JOHN A. MCGREEVY AND ROBERT T. HEATH, KENT STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, KENT OH 44240-0001.**

The purpose of this study was to explore whether benthic bacterial production was controlled through "bottom-up" (carbon enrichment provided by macrophytes) or "top-down" (protozoan bacterivory) processes. We determined bacterial productivity ($[^3H]$-leucine method) and protozoan grazing rates using fluorescently-tagged sediment in benthic cores removed from two sites at Old Woman Creek National Estuarine Research Reserve, Huron, OH. Sites were selected because they differed in presence or absence of the macrophyte *Nelumbo lutea* (American water lotus). We found fresh *Nelumbo* leaves rapidly leached dissolved organic matter (DOM). Bacterial numbers ranged 1- $11x10^8$ mL^{-1}; bacterial production ranged 1-$60x10^4$ μg C mL^{-1} per hour; sediment DOM ranged 7-70 μg C L^{-1}. Bacterial numbers and production were positively related to carbon availability. Protozoan numbers (live counts) ranged 2-$6x10^4$ mL^{-1} (flagellates) and 4-$10x10^3$ mL^{-1} (ciliates) and were inversely related to bacterial production. These findings suggest bacterial production is controlled by availability of organic matter, but the relationship between bacterial production and protozoan activities is unclear. This study was supported by Ohio Sea Grant.

9:45 GENETIC RELATIONSHIPS OF DREISSENID MUSSELS FROM NORTH AMERICAN AND EURASIAN POPULATIONS. **JENNIFER L. SKIDMORE AND CAROL A. STEPIEN, CASE WESTERN RESERVE UNIVERSITY, DEPT OF BIOLOGY, CLEVELAND OH 44106-7080.**

The objective was to determine the possible genetic origin(s) and degree of genetic variability of invasive dreissenid mussel populations in North America versus native Eurasian populations. Genetic data comprise 60 nuclear RAPDs markers from 12 nonindigenous North American and 7 Eurasian populations, representing the ranges of the zebra mussel *Dreissena polymorpha* (N=272 samples) and the quagga mussel *D. bugensis* (N=90). Data analyses include Fst tests, corrected chi-square tests, genetic distance neighbor-joining trees, and maximum parsimony. Results indicate that North American zebra mussel populations were founded from multiple Eurasian sources. Populations in Lakes Superior and Huron are similar to those in northwestern Europe. Lakes Erie and Ontario populations show close relationships to northwestern and central European sites. The southern Mississippi River population is more similar to west central Europe than to sites in the Great Lakes, suggesting separate colonizations. Eastern Europe did not contribute zebra mussels to North America. The quagga mussel diverged in the Great Lakes from its native Ukrainian population. The deepwater profundal quagga variant shows greater similarity to native Ukrainian samples. Large populations of mussels were introduced to North America from multiple founding sources, genetic polymorphism levels of nonindigenous and native populations are comparable, and populations are genetically divergent.

10:00 USE OF REDOX POTENTIALS TO DETERMINE EFFECTS OF BURROWING MAYFLIES (*HEXAGENIA* SPP.) AND ZEBRA/QUAGGA MUSSELS (*DREISSENA* SPP.) ON SEDIMENT OXYGENATION. **DAVID J. DARIANO AND KENNETH A. KRIEGER, HEIDELBERG COLLEGE, WATER QUALITY LABORATORY, 310 E MARKET ST, TIFFIN OH 44883.**

Mayflies of the genus *Hexagenia* have attained high densities in the bottom sediments of much of western Lake Erie. By circulating water through their burrows, they may be oxygenating the subsurface sediments. By contrast, zebra mussels and quagga mussels (*Dreissena* spp.) have recently invaded the surface of large areas of bottom sediments and may be forming a barrier to sediment oxygenation. We investigated the use of platinum microelectrodes to measure differences in sediment reduction-oxidation potentials across small vertical and horizontal distances as a means to detect microhabitat differences in sediment oxygenation. Our results showed that individual *Hexagenia* nymphs increase sediment oxygenation only 2-3 mm from their burrows, but that aggregations of nymphs may increase sediment redox potentials slightly. A surface layer of *Dreissena* shells had no measurable impact on sediment redox conditions at depths ≧1 cm.

10:15 CHANGES IN THE DIETS OF FOUR FORAGE FISHES IN WESTERN LAKE ERIE IN RELATION TO CHANGES IN THE BENTHIC INVERTEBRATE COMMUNITY. **Kenneth A. Krieger, Laura A. Shields, Stacie L. Wildman, James B. Saxton, and Kevin G. Boggs, Heidelberg College, Water Quality Laboratory, 310 E Market St, Tiffin OH 44883.**

The stomach contents of four forage fishes in western Lake Erie were analyzed to determine the rates of incorporation of nymphs of the burrowing mayfly *Hexagenia* spp. into their diets. The mayflies have rapidly recolonized the western basin since 1991 and have become the most abundant invertebrate in the soft sediments that comprise most of the lake bottom. The fish were collected in May, June, and July, 1995 through 1998. Troutperch (*Percopsis omiscomaycus*), silver chubs (*Hybopsis storeriana*), and spottail shiners (*Notropis hudsonius*) included *Hexagenia* in their diets in increasing numbers (nymphs/fish and percent of fish containing nymphs) from 1995 through 1997, but in smaller numbers in 1998. Emerald shiners (*Notropis atherinoides atherinoides*) were strictly zooplanktivorous. The contribution of *Hexagenia* to the diets of the other three fishes appeared to reflect directly the varying density of nymphs in the sediments from year to year. The burrowing mayflies have regained their role as an important link in the benthic-pelagic food web of the western basin.

10:30 IS COLD ACCLIMATION RESPONSE VARIABLE AMONG THE SUNFISHES (CENTRARCHIDAE)? **Deidra R. Tschantz, Richard L. Londraville, University of Akron, Dept of Biology, Akron OH 44325-3908.**

We acclimated members of the sunfish family (green sunfish, *Lepomis cyanellus*, GS and largemouth bass, *Micropterus salmoides*, LMB) to body temperatures of 5°C and 25°C for 8 weeks. The purpose of the study was to determine if cold acclimation ability, as judged by tissue somatic indices and subcellular changes, follows a phylogenetic pattern. Cold acclimation ability was judged by an increase in one of several measured variables for cold-acclimated fish vs. warm-acclimated fish when measured at a common cold temperature. The following variables were measured: hepato- and cardio-somatic indices, enzymatic indicators of cellular respiration (hexokinase, carnitine palmitoyltransferase, cytochrome oxidase, and lactate dehydrogenase), and swimming activity. Preliminary data indicate that hepatosomatic indices of GS (warm 2.74 ± 0.24, cold 2.06 ± 0.15) and LMB (warm 3.07 ± 0.39, cold 2.81 ± 0.33) decrease in response to cold acclimation. Cardiosomatic indices in GS (warm 0.11 ± 0.02, cold 0.10 ± 0.006) decrease in response to cold acclimation; however, LMB do not change (warm 0.07 ± 0.006, cold 0.08 ± 0.01). Total-heart hexokinase activity, an indicator of aerobic carbohydrate metabolism, increases upon cold acclimation in LMB when measured at 5°C (warm 0.43 ± 0.19 U/heart, cold 0.65 ± 0.12 U/heart). However, in GS, there does not appear to be an acclimation effect (warm 0.22 ± 0.03 U/heart, cold 0.24 ± 0.03 U/heart). Heart oxidative metabolism, measured by total cytochrome oxidase activity, did not change upon acclimation in GS at 5°C (warm 1.33 ± 0.20 U/heart, cold 1.12 ± 0.14 U/heart). Total-liver cytochrome oxidase activities increase upon cold acclimation in GS when measured at 5°C (warm 4.02 ± 0.68 U/liver, cold 6.36 ± 2.21 U/liver). We have established that species within the sunfish family do respond differently to cold acclimation. Similar analyses with other sunfish species will establish if this variation follows a phylogenetic pattern.

10:45 HEAT TOLERANCE IN *RHINICTHYS ATRATULUS* AND MICROHABITAT VARIATION IN TEMPERATURE IN HEADWATER STREAMS IN KNOX CO., OHIO. **Michelle L. Santangelo and E. Raymond Heithaus, Kenyon College, Biology Dept, Gambier OH 43022.**

Deforestation adjacent to headwater streams reduces aquatic biodiversity, but the spatial scale of effects within streams is poorly understood. This study characterizes the spatial scale of temperature variation in one, second order stream. We also test for local adaptation to temperature in Black-nosed Dace, *Rhinicthys atratulus*, a species commonly found in headwater streams. Four temperature data loggers were placed in exposed and shaded sites in Wolf Run, a tributary to the Kokosing River. Temperature was recorded for 54 days, starting July 3, 1998. At least 24 individuals of *R. atratulus* were collected by electrofishing in each of paired shaded and exposed sites in four streams. Fish from each site were evenly divided into two treatments in environmental chambers; the experimental group was heat stressed by a daily 2°C increase from the control of 19°C, followed by a rapid decrease to 22°C for two days and a shock to 31°C. Lack of shade and shallow water increased both mean temperature and variation. The largest difference was observed between two sites just 190 m apart in stream distance. Fish from shaded sites (49.3% survival) were more tolerant to heat stress than those from exposed sites (30.2% survival). This result suggests that even within streams, fish from shaded sites differ in heat tolerance and may be chronically less stressed than fish exposed to higher temperatures and higher microhabitat variation. This occurs in spite of potential movement and gene flow within streams.

Zoology

02:00PM Saturday, April 24, 1999

Main Classroom Bldg. - 101

Michael Walton - Presiding

2:00 COMMUNITY STRUCTURE OF BENTHIC INVERTEBRATES ON A COZUMEL REEF. **Staci R. Sherman and Michael L. Deeter (Philip C. Whitford), Capital University, Biology Dept, 2199 E Main St, Columbus OH 43209.**

Research is to be conducted on fore reef, hind reef and reef crest environments of a single section of near-shore reef off the coast of Cozumel, Mexico to determine whether there is a difference in species present and species relative abundance in each of these life zones. Our hypothesis is that each region of the reef is sufficiently different in physical characteristics that they should reflect that difference by evidencing significantly different communities of benthic organisms. Species to be studied include sedentary poriferans, octocorals and hard coral forms, species which will remain in place to permit line transect assessment of population density and species present. Data collection is to be done using a modified Loya line transect method for data gathering from two 50 m transects in each of the three reef zones on a single reef. Data collection is slated for 7 January to 15 January, 1999 using self-contained underwater breathing apparatus (SCUBA) during 2-3 hours immersion per day. This time frame should permit species identification and collection of species density/bottom coverage data for the designated areas. Data analysis is designed to use Minitab statistical package to compare species presence and abundance between each of the three reef environments to determine whether the hypothesis of significant difference in community structure is supported.

2:15 ARE CASTE RATIOS IN *APHAENOGASTER RUDIS* SENSITIVE TO RESOURCE ABUNDANCE? **Melisa L. Holman and E. Raymond Heithaus, Kenyon College, Biology Dept, Gambier OH 43022.**

In ants, the ratio of investment to males and reproductive females (gynes) is rarely even. At a population level, unequal investment may reflect genetic conflicts between queens and workers, but at the colony level investment tends to be highly skewed to either males or gynes. We asked whether this largely unexplained, extreme variation is a response to variation in local resource levels for a species with a simple social structure. *Aphaenogaster rudis* is a monogynous, singly-mated species that nests in fallen branches or under rocks in forest habitats. We evaluated the influence of resource abundance on the expression of sex ratios by feeding 4 groups of 10 lab-reared colonies a standard lab diet at intervals of 1, 2, 4, or 8 days. To track allocation among castes, we also provided a pulse of radio-labeled, fat-rich arils from ant-dispersed seeds (*Sanguinaria canadensis*) or mealworms. We then counted reproductive individuals and measured colony size after most alates had closed. We hypothesized that colonies with more background nutrient would distribute more fat-rich food to female larvae, increasing investment in gynes. Mortality in the colonies fed every 8 days was 87% higher than in the other treatments, indicating that the experimental regime mimicked a range of stress. However, reproductive output did not differ among the treatment groups (P=0.48). The sex investment ratios (gynes/total alates) were distributed in the typical U-shaped pattern seen to occur in nature (mean = 0.414 ± 0.399 S.E.), but this variation was not explained by differences in the resource base.

2:30 ALLELIC DIVERSITY OF MHC MOLECULES OF THE SUMATRAN RHINOCEROS *DICERORHINUS SUMATRENSIS*. **Donna M. Cain (Simon Lawrance), Otterbein College, Dept of Life and Earth Sciences, Westerville OH 43081.**

The Sumatran rhino, *Dicerorhinus sumatrensis*, is the smallest and most endangered of five living rhino species, with fewer than 400 left in the wild. Captive breeding programs of this species have been unsuccessful. A goal of captive breeding programs is to maintain genetic diversity within species, with MHC polymorphism a priority. MHC variation contributes to kin recognition, mating choices, and enhanced resistance to pathogens. Genetic analysis of the MHC genes of possible breeding pairs of *D. sumatrensis* may contribute information valuable for successful management of captive breeding programs. A portion of the variable region of the MHC II gene sequence has been amplified by PCR. The primers used incorporate EcoRI and BamHI sites into the PCR product. The amplified MHC gene sequences are now being cloned into p Bluescript/KS(+) using the EcoRI and BamHI sites in this vector. The Sanger sequencing method will be used to determine the DNA sequences of the cloned MHC genes. The APD method will be used to compare MHC sequences between individual Sumatran rhinos.

2:45 INDIVIDUAL AND POPULATION RESPONSES TO DIFFERENT PREDATOR TYPES IN TRINIDADIAN GUPPIES (*POECILIA RETICULATA*). **Christopher N. Templeton (Walter M. Shriner), Denison University, Dept of Biology, Granville OH 43023.**

The anti-predator behavior of *Poecilia reticulata* has been widely studied. Past studies have focused on interactions with fish predators, but have ignored aerial predators. It is important to understand the influence of aerial predators because they can occur independently of fish predators and may exert substantial selective pressures on the behavior of *P. reticulata*. This research examines the degree to which aerial predation may have influenced the evolution of guppy behavior. Simulated predator attacks will be conducted in the laboratory to determine whether differences occur in anti-predator behavior between bird and fish predators, between populations caught from areas of high and low fish predation, and between experienced (wild-

caught) and naive (laboratory-reared) *P. reticulata*. Initial qualitative work suggests that *P. reticulata* react strongly to overhead stimuli, but it is not known how these behaviors relate to those elicited by fish predators; no quantitative data have been gathered to date.

3:00 ENERGY ACQUISITION CONSTRAINS CALLING IN TREEFROGS: A DIET-ENHANCEMENT EXPERIMENT WITH *HYLA VERSICOLOR*. MICHAEL WALTON AND GEZA VARHEGYI, CLEVELAND STATE UNIVERSITY, DEPT OF BIOLOGICAL, GEOLOGICAL & ENVIRONMENTAL SCIENCES, CLEVELAND OH 44115.

Advertisement call characteristics and calling effort were quantified for numerous individual male grey treefrogs, *Hyla versicolor*, to determine (1) if individual males differ in calling behavior, (2) which aspects of calling behavior are linked to mating success, and (3) if calling behavior is constrained by energy availability. Individual male frogs, marked with unique toe-clips, were recorded and scored for mating success (amplexus) nightly at sites within the Cuyahoga River Valley during the 1994, 1995, 1996, and 1997 breeding seasons. Although substantial interindividual variability was found in calling behavior (call rate, call duration, call intensity) and calling effort (hours of calling per night, number of nights calling), only the number of nights calling demonstrated a significant relationship with mating success, i.e., the most persistent males mated most often. During the 1997 season, we assessed the effects of foraging success on calling effort through a diet enhancement experiment. Ten to twelve individual frogs were periodically given a bucco-pharyngeal injection of a cricket/mealworm slurry of standardized caloric content; ten to twelve control frogs were given water of the same volume. At two different locations, diet-enhanced frogs called on 45-50% more nights than controls, suggesting that prey availability and/or foraging abilities are linked to mating success in these frogs.

3:15 ASPECTS OF THE REPRODUCTIVE ECOLOGY OF FEMALE MIDLAND PAINTED TURTLES (*CHRYSEMYS PICTA MARGINATA*) AT THE DENISON UNIVERSITY BIOLOGICAL RESERVE. NATALIE K. MARIONI (LINDA C. ZIMMERMAN), DENISON UNIVERSITY, SLAYTER BOX 1457, GRANVILLE OH 43023.

The purpose of this project was to consider various ecological aspects of a single *Chrysemys picta marginata* population at the Denison University Biological Reserve including nesting and reproductive ecology, with four main objectives. These objectives included an analysis of reproductive output, nesting conditions, and incubation conditions (soil moisture and temperature), and a continuation of a population survey. Gravid females were captured and transmitters were attached to the carapace so the females could be located while nesting. Four viable nests and six predated nests were found. Nests were excavated to remove the eggs and measured them. Initial comparisons of female size to egg size showed a positive correlation. The top, middle and bottom of nests were equipped with thermocouple wires before returning eggs, and a soil moisture sensor was placed in the soil next to the nests. Three 50 meter long transects were established extending away from three ponds into potential nest site areas. At five plots along each transect, three thermocouples and a soil moisture sensor were placed into the soil at nest depths. Daily soil conditions were recorded for each nest and transect plot. These will be used to estimate the sex of hatchlings and to predict relative size of hatchlings. Preliminary data analysis suggests that hatchlings from the first two nests developed into males. Findings of this research will be compared to studies of *Chrysemys picta* in different regions throughout its broad geographic range.

3:30 LACK OF EDGE EFFECT ON BIRDS BREEDING IN MATURE BEECH-MAPLE FOREST. COURTENAY N. WILLIS, YOUNGSTOWN STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, YOUNGSTOWN OH 44555.

We assessed avian nesting success of the most common forest songbirds in a late-successional, 10 ha beech-maple forest plot adjacent to a road edge at the Ravenna Army Ammunition Plant in Portage County, Ohio. Nests were located and monitored using standard BBIRD (*Breeding Biology and Research Database*) protocol. In 1997 and 1998, we found a total of 78 nests of 10 species, 36 of which were active. Nesting success for all species combined was 67% (24/36). The most common species nesting at our site, in decreasing order of the number of nests found, were acadian flycatcher (*Empidonax virescens*), red-eyed vireo (*Vireo olivaceus*), wood thrush (*Hylocichla mustelina*), american redstart (*Setophaga ruticilla*), and ruby-throated hummingbird (*Archilochus colubris*). The nesting success of the acadian flycatcher, the most common species nesting at our site, was 85% (11/13). For all nests found, predation was the most common mortality factor, causing 31% (11/36) of known failures. Brown-headed cowbird (*Molothrus ater*) parasitism was extremely low. Only two of the nests found were parasitized, neither of which successfully fledged young. These results suggest that the forest we studied may serve as an important breeding area for some Neotropical migrants.

3:45 USE OF NEST BOXES BY THE HOODED MERGANSER AT MOSQUITO CREEK WILDLIFE MANAGEMENT AREA. KIMBERLY S. LUDT AND COURTENAY N. WILLIS, YOUNGSTOWN STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, YOUNGSTOWN OH 44555.

We conducted an intensive nest box study on the hooded merganser, *Lophodytes cucullatus*, at Mosquito Creek Wildlife Management Area in Trumbull County, Ohio. The purpose of the study was to determine whether local hooded merganser populations are increasing, and what effect this might have on their nesting success. Our data were compared with an intensive study of 40 nest boxes on Wood Duck Marsh (113 ha) in 1994 and 1995. From March through July 1998, we visited the same nest boxes two to three times per week to determine the proportion of nest boxes used by hooded mergansers and to estimate their nesting and hatching success. An increase in nest box use from 21% (1994-1995) to 30% (1998) was inversely correlated with a decrease in nesting success from 80% (1994-1995) to 75% (1998). In addition, we noted a significant decrease in hatching success from 90% (1994-1995) to 78% (1998) ($p<0.05$). However, average clutch sizes did not differ between 1994-1995 (14 ± 4.0 eggs) and 1998 (14 ± 4.4 eggs). Therefore, intraspecific nest parasitism did not appear to influence hatching success. In conclusion, increases in the hooded merganser population we studied were correlated with lower hatching success, which may be due to interference with wood ducks, *Aix sponsa*, that also use these boxes.

4:00 MICROHABITAT USE BY THE MEADOW VOLE ON A RECLAIMED GRASSLAND. JASON J. ANDERSON AND JOHN D. USIS, YOUNGSTOWN STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, ONE UNIVERSITY PLAZA, YOUNGSTOWN OH 44455.

We examined the effects of microhabitat quality on the population dynamics and dispersal behavior of the meadow vole, *Microtus pennsylvanicus*, at Browning Ferris Industries-Carbon Limestone Landfill/CLD, Mahoning Co., Ohio. Voles were live-trapped from May 19 to October 23, 1998 for a total of 80 trap nights using 72 Sherman traps (4 per 0.04ha) in 18 experimental grassland patches varying in density and quality of vegetative cover. Plant species distribution were analyzed using Atlas GIS in order to determine relative coverage and dominance relationships. Dry weight biomass of standing crop and litter was also used to distinguish patch quality. Grassland patches were categorized into four microhabitat types based on coverage values of the high quality forage species. Responses of recaptured individuals displayed a 31% increase for patches with a high clover (*Trifolium repens* and *T. pratense*) and grass (*Festuca elatior* and *Setaria faberii*) mixture in comparison with patches of low clover coverage but high grass bundance. Differences in the density and residence times of voles show a strong preference for microhabitats with a clover coverage greater than 20%.

4:15 HABITAT USE OF PRIMATES IN A VENEZUELAN TROPICAL DRY FOREST. ELIZABETH CONGDON, MICHAEL WALTON, AND PATRICIA MCDANIEL, CLEVELAND STATE UNIVERSITY, DEPT OF BIOLOGICAL, GEOLOGICAL, AND ENVIRONMENTAL SCIENCES, CLEVELAND OH 44115.

This study investigates the distribution and habitat use of primates found within the Caparo Forestry Reserve in Barinas, Venezuela. Three primate species are found within this reserve: hybrid spider monkeys (*Ateles belzebuth hybridus*), red howler monkeys (*Alouatta seniculus*), and white-fronted capuchins (*Cebus albifrons*). Caparo is situated in one of the last remaining patches of tropical dry forest in Venezuela. The management practice of selective logging provides opportunity to examine species' use of habitats of varying degrees of exploitation while a Biodiversity Reserve offers roughly 2200 hectares of virtually non-disturbed forest. Data was collected in the dry season of 1998 using opportunistic scan sampling along transects. Distribution was mapped and general activity categories were used to monitor primate use of the different micro-habitat types. Interspecific comparisons indicate a greater overlap in the howler monkey and spider monkey selection of tree species and food items than either species with capuchins. However, the spider monkeys seem to have moved out of the drier areas during extreme heat while the other two species remained. All results of this study will be provided to the managers of the reserve in the hopes that future plans will include consideration of the possible effects on the primates.

4:30 DETERMINING THE BIOLOGICAL STATUS OF COYOTES IN THE CUYAHOGA VALLEY NATIONAL RECREATION AREA. JONATHON D. CEPEK, CLEVELAND STATE UNIVERSITY, CENTER FOR ENVIRONMENTAL SCIENCE, TECHNOLOGY AND POLICY, 1899 EAST 22ND ST. MC219, CLEVELAND OH 44114-4434.

The Cuyahoga Valley National Recreation Area (CVNRA) is a 33,000 acre park suffering from the pressures of increased urbanization in surrounding areas, which include the metropolitan centers of Cleveland and Akron. This project compares the use of various methods of coyote (*Canis latrans*) study in this area and establishes baseline data on the coyote population of the CVNRA for future monitoring. Due to the potential for coyotes to continue to expand their numbers into urban areas, it is essential to find effective methods with which to monitor populations. Methods successfully used in the western U.S. by government agencies may not be adequate for use in this type of system. Objectives are to determine the best method to monitor the coyote population of the CVNRA, estimate population size and distribution, and determine the general diet. Scent station analysis, howling surveys and tracking are the study methods compared, and scat sample analysis is used to determine diet. Results indicate that the howling survey is the most successful population monitoring method. Use of scent stations in the CVNRA is limited by: 1) native soil, which does not display clear prints; 2) high public use and dog (*Canis domesticus*) interference; and 3) raccoon and deer densities. The use of wildlife camera systems or radio-collaring may improve the study of coyotes in a high public use, or urban area.

PLANT ECOLOGY AND FLORISTICS
09:00AM SATURDAY, APRIL 24, 1999
MAIN CLASSROOM BLDG. - 103
BRIAN C. MCCARTHY - PRESIDING

9:00 COMPOSITION, STRUCTURE, AND DIVERSITY OF WOODY VEGETATION IN MATURE AND REORGANIZING FOREST STANDS OF SOUTHEASTERN OHIO. CHRISTINE J. SMALL AND BRIAN C. MCCARTHY, OHIO UNIVERSITY, DEPT OF ENVIRONMENTAL AND PLANT BIOLOGY, ATHENS OH 45701.

The influence of disturbance on natural systems is a central question in ecological research. Clearcut harvesting is a stand-level disturbance, altering forest structure and composition by

removing reservoirs of species diversity and producing dramatic environmental changes. We examined woody vegetation in clearcut and mature second-growth deciduous forest stands at Waterloo Wildlife Experimental Station, Athens County, Ohio. Data on seedling, sapling, and tree strata were collected in 2.5, 25, and 250 m^2 sampling plots. Overstory clearcut vegetation was dominated by *Acer rubrum*, *Liriodendron tulipifera*, and *Quercus prinus*. Common clearcut understory species included *Smilax rotundifolia*, *Rubus* spp., *A. rubrum*, and *L. tulipifera*. Overstory forest vegetation was dominated by *A. rubrum*, *Q. prinus*, *Q. velutina*, *Fagus grandifolia*, and *Cornus florida*. Common understory forest species included *A. rubrum*, *Sassafras albidum*, *Smilax rotundifolia*, and *Viburnum acerifolium*. Overstory clearcut vegetation exhibited greater richness (S = 32, 24) and density (3,468 ± 299, 1,012 ± 74 stems/ha) but lower diversity (H' = 2.29, 2.44; E = 0.310, 0.479) and basal area (5.83 ± 0.62, 26.83 ± 2.23 m^2/ha) than forests. Understory richness was similar in clearcuts and forests (sapling S = 44, 44; seedling S = 35, 33), although clearcuts showed greater diversity (sapling H' = 3.13, 2.75; E = 0.520, 0.356; seedling H' = 2.96, 2.74; E = 0.554, 0.469). Detrended correspondence analysis showed a significant correlation between understory and overstory species composition in mature but not clearcut stands. This supports other recent findings suggesting increased linkage between strata with stand age.

9:15 COMPOSITION, STRUCTURE, AND SUCCESSIONAL DYNAMICS OF JOHNSON WOODS, AN OLD-GROWTH FOREST FRAGMENT IN TRANSITION. **Paul A. Heimberger and David M. Hix, 7831 Meadowhaven Blvd., Columbus OH 43235.**

Johnson Woods State Nature Preserve is an 83.5 ha old-growth forest fragment in northeastern Wayne County, Ohio. The renowned Ohio ecologist E. Lucy Braun collected compositional data at Johnson Woods (aka Graber Woods) during the first part of this century, concluding that the forest, viewed in its entirety, was predominantly an old-growth white oak forest. However, Braun emphasized that developmental trends in depressions and on swells, in conjunction with evidence from understory regeneration, were leading to the ultimate establishment of the classic regional climax forest type, American beech-sugar maple. In order to study the species distribution patterns and Braun's predicted successional dynamics of the woody vegetation, east-west line transects were laid and a total of sixty non-overlapping, fixed radius plots with nested sampling design were established. Seventeen tree species were encountered and stand-level diameter distributions were of the reverse-J form typical of old-growth forests. Tree (dbh≧10cm), sapling (dbh<10cm, ht≧1.37m), seedling (ht<1.37m), standing dead (snag), and coarse woody debris data do indicate that dominance patterns are shifting. Although white oak is still a relatively important canopy species (IV=16.5%), sugar maple (IV=15.3) and beech (IV=21.4%) have increased significantly in dominance. White oak seedlings are well represented in the ground cover but entirely absent in the sapling layer. Advanced regeneration patterns thus indicate that Johnson Woods is a forest in transition.

9:30 RESPONSE AND RESISTANCE TO NUTRIENT PERTURBATION IN OLD FIELDS OF VARYING AGES. **Gwen M. Sturgill, Jocelyn Muller, and Mary Benninger Truax, Hiram College, Biology Dept, Hiram OH 44234.**

A 4 year examination of the effects of perturbation by two types of fertilizer on old fields of varying ages was conducted at Hiram College s J.H. Barrow Field Station. In May, 1995, twenty four 16 x 20 m plots were established in a former corn field. Three plots were treated with ammonium nitrate (N) fertilizer in Year 1 only (1995), three were treated with N fertilizer in Year 3 only (1997), and three were treated with N fertilizer each of the four years. Diammonium phosphate (N/P) fertilizer was applied to nine other plots using the same protocol. All treated plots received 300 kg/ha nitrogen per year; N/P plots also received 768 kg/ha phosphorus per year. Above ground plant material was harvested, dried, and weighed three times during the growing season. Plots treated in Year 1 or Year 3 were compared to control plots and those treated consecutive years. We predicted that plots perturbed in Year 3, after vegetation had already been established, would be less affected by and would recover more quickly from perturbation than those fertilized immediately following tillage. We also suspected that community composition would differ between N and N/P fertilized plots due to species level differences in nutrient limitation. Plots treated consecutive years showed typical arrested succession, with dominance by one or a few early successional species. The dominant species differed between the two treatments. Year 1 plots initially resembled those treated consecutive years, but they resembled the control plots by the third year. Year 3 plots deviated only slightly from control plot parameters, and they recovered more quickly than Year 1 plots. We acknowledge support for this research project from Dr. Bruce and Janet Johnson and the Howard Hughes Medical Institute.

9:45 SPATIAL AND TEMPORAL CHANGES IN SOIL MOISTURE ACROSS THREE LAND USE LEGACIES. **Tonia L. White, Mount Union College, 1972 Clark Ave, Alliance OH 44601.**

Soil moisture is crucial to growth and development of herbaceous plants and seedling trees. Prior land use, particularly agricultural practices, may alter soil properties such as moisture by reducing organic matter in the O horizon. Soil moisture was studied in a temperate hardwood forest in central Massachusetts dominated by *Quercus rubra* and *Acer rubrum*. Six plots were sampled, two of each land use legacy: plowed, pastured, and woodlot. These plots were reforested since agricultural abandonment in the late 1880's. Moisture was determined gravimetrically throughout June and July 1998. Woodlots showed significantly higher moisture values than agricultural sites. Although the woodlot moisture values appeared more variable, the moisture content over the summer followed the general trend plowed<pastured<woodlot, with the woodlots showing 50% greater soil moisture. Temporal variability differed among sites, with the greatest differences occurring mostly in the forest floor. Disturbed lands exhibited thinner O horizons compared to the woodlots and were consistently drier. The thick O horizon in the woodlots is significant to herbaceous species and seedlings because it accommodates most of the these species total moisture requirements.

10:00 THE EFFECTS OF MICRO- AND MACROHABITAT VARIATION ON THE INVASIVE SUCCESS OF *ALLIARIA PETIOLATA*, A NON-INDIGENOUS FOREST HERB. **J. Forrest Meekins and Brian C. McCarthy, Ohio University, Dept of Plant Biology, Athens OH 45701.**

Traditionally, intact mature forests have been considered to be highly resistant to plant invasions. However, *Alliaria petiolata* (garlic mustard), a non-indigenous biennial, commonly invades a variety of seemingly undisturbed forested communities throughout northeastern North America. The objective of this experiment was to determine the role of environmental disturbance and habitat variation in *A. petiolata's* establishment. To examine the effect of habitat variation, plots were established in 2 upland and 2 ravine communities on the edge or within the forest, then assigned to 1 of 3 litter removal treatments. Seeds were sown into plots in November 1996 and monitored for 2 years. Plants became established under all treatment conditions. In June 1998, plants were harvested and dried. A 4-way MANOVA followed by ANOVAs for each variable measured, indicated plants in the moister ravine habitat had significantly higher germination and survival and greater total biomass and seed production than plants in the drier upland habitat. In addition, plants along the edge had higher germination and greater seed production per fruit than plants under the forest canopy. These results indicate that *A. petiolata* does not require either a macrohabitat (i.e., light) or microhabitat (i.e., litter) disturbance to become established in a new area, but the chances of a successful invasion are higher in environments with greater light and moisture availability.

10:15 DENDROCHRONOLOGICAL ANALYSIS OF OLD-GROWTH WHITE OAK FROM DYSART WOODS, BELMONT COUNTY, OHIO. **Darrin L. Rubino and Brian C. McCarthy, Ohio University, Dept. of Env. & Plant Biology, Athens OH 45701.**

Dendrochronological techniques were applied to white oak (*Quercus alba*) from an old-growth mixed mesophytic forest in eastern Ohio in order to determine patterns of stand disturbance history and climate relations. Ten white oak trees were sampled and yielded a 374 yr master chronology (1625 - 1998). Release events were identified as periods of sustained annual growth (10 yr) which exceeded the previous 10 yr median growth rate by a minimum of 25%. Thirty-eight releases were identified. The number of release events per tree ranged from 2 to 5 (mean 3.8 ± 0.4 SE). Release events ranged from 1 to 38 (7.6 ± 1.1) years in length. The mean release return interval ranged from 6 - 83 (33.8 ± 3.9) yr. Synchronous releases (40% or more of trees showing a release in a single year) were noted 15% of the time. The presence of synchronous and asynchronous release events suggests gap-phase dynamics as the primary disturbance regime at Dysart Woods. However, one of three slab samples showed fire scars at 1770, 1782, 1793, and 1833. Annual growth increments were significantly correlated with mean growing season precipitation and modified Palmer drought severity index ($r = 0.40$; $p < 0.001$ and $r = 0.35$; $p < 0.001$, respectively). Thus, the climate signal is sufficiently strong even in old-growth white oak trees growing under the complacent conditions typical of upland mesophytic forests.

10:30 AN EVALUATION OF RADIAL GROWTH AVERAGING CRITERIA USED FOR THE RECONSTRUCTION OF FOREST STAND DISTURBANCE HISTORIES. **Brian C. McCarthy and Darrin L. Rubino, Ohio University, Dept of Env. & Plant Biology, Athens OH 45701.**

Historically, dendrochronology has largely focused on the reconstruction of past climates. More recently, forest ecologists have recognized the potential for using radial growth analysis to investigate past disturbance histories of hardwood stands. However, recent studies suggest that the criteria used to evaluate release and suppression events may have an effect on overall interpretations. Through the use of increment cores, plunge blocks, and slabs (N = 10), we established a 374 year-old chronology for white oak (*Quercus alba*) obtained from Dysart Woods, Belmont County, Ohio. Using three previously published methods, we applied various radial growth averaging criteria to our samples, along with a new method we are proposing. We varied growth response thresholds (25 and 50%), running average period (10 or 15 years), and measures of central tendency (mean and median). While not previously tested, we discovered that many running average samples (5-20%, within and among samples) are not normally distributed ($P < 0.05$), and thus the median tended to be a much better measure of central tendency than the mean. Comparisons of the various permutations suggest that there is general agreement among methodologies; however, there was often great variation from sample to sample. Thus, we propose a 10-yr running median with a 25% threshold for most radial averaging analysis of eastern US oak species.

10:45 COMPETITIVE INTERACTION BETWEEN PURPLE LOOSESTRIFE (*LYTHRUM SALICARIA*) AND WINGED LOOSESTRIFE (*LYTHRUM ALATUM*). **Joel L. Thompson (Beverly J. Brown and Randy Mitchell), University of Akron, Dept of Biology, Akron OH 44325-3908.**

The invasive alien, purple loosestrife (*Lythrum salicaria*) is superlative at taking over wetland habitats and creating monocultures. This fact raised the question "How exactly does purple loosestrife compete with the native species?" In response, an experiment was performed to determine the effect on the native winged loosestrife (*Lythrum alatum*) when in direct competition with purple loosestrife. The experiment consisted of control groups of single species plantings, and experimental groups of mixed species plantings. The presence of purple loosestrife does affect the growth rate of winged loosestrife to some extent. Germination time may also be a factor with purple loosestrife germinating in 3-5 days whereas winged loosestrife germinates in 7-10 days.

PLANT ECOLOGY, FLORISTICS, SYSTEMATICS, REPRODUCTIVE BIOLOGY; HISTORY; PALEOBOTANY

01:45PM SATURDAY, APRIL 24, 1999

MAIN CLASSROOM BLDG. - 103

ALLISON W. CUSICK - PRESIDING

1:45 DISTRIBUTION, FREQUENCY AND HABITATS OF THREE SPECIES OF LEAFY BULRUSHES (*SCIRPUS*;CYPERACEAE) IN OHIO. **ALLISON W. CUSICK, ODNR, DIV OF NATURAL AREAS AND PRESERVES, FOUNTAIN SQ, COLUMBUS OH 43224.**

Scirpus atrovirens Willd., *S. georgianus* Harper and *S. hattorianus* Makino are widespread in Ohio. Because of their superficial resemblance to one another, these leafy bulrushes frequently have been misidentified. They are separated by achene, leaf and sheath characters. Field and herbarium surveys were conducted to clarify the distribution, frequency and habitats of these taxa. *Scirpus atrovirens* is distributed throughout Ohio. *Scirpus georgianus* is common in eastern Ohio, but rare or absent in the western half of the state. Both these species grow in a variety of sunny wetlands as well as in roadside ditches. *Scirpus hattorianus* is frequent in northern and eastern Ohio; it is rare or absent in southwest and west central Ohio. *Scirpus hattorianus* often grows in shadier sites than the other two species, such as in moist openings and along trails in woodlands. *Scirpus hattorianus* occasionally is found along roadsides. These three species may grow in close proximity to one another, but mixed populations are not documented in Ohio.

2:00 COMPOSITION AND DIVERSITY OF FOREST COMMUNITIES AT DEEP WOODS COMMUNITY FARM, HOCKING COUNTY, OHIO. **CYNTHIA L. RICCARDI AND BRIAN C. MCCARTHY, OHIO UNIVERSITY, DEPT OF ENVIRONMENTAL AND PLANT BIOLOGY, ATHENS OH 45701.**

The composition and diversity of woody vegetation was examined at Deep Woods, a 114-ha second-growth forest located in Hocking County, Ohio. The area is presently the site of an all taxa biotic survey coordinated by the Ohio Biological Survey, of which this study is a part. From a conservation perspective, the area is unique in its diversity of habitats and includes pasture fields, lowland and upland hardwood forest, riparian forest, hemlock ravines, sandstone outcrops, and rockhouse formations. There are three major forest vegetation types: hydric floodplain, mesic upland, and xeric ridgetop. All woody vegetation greater than 2.5 cm dbh was sampled in twenty-two 0.1 ha circular plots. Thirty-five species were identified. The flood plain was dominated by *Betula nigra, Carpinus caroliniana,* and *Ulmus rubra* and had a mean density of 577.1 stems/ha and a basal area of 21.4 m^2/ha. It also exhibited the greatest richness and diversity (S = 25, H' = 2.46). The upland community closely resembles northern hemlock-hardwood forests and was dominated by *Liriodendron tulipifera, Acer saccharum,* and *Betula alleghaniensis* (655.0 stems/ha, 27.5 m^2/ha, S = 24, H'= 2.31). The xeric ridgetop community was dominated by *Acer rubrum, Quercus prinus,* and *Quercus alba* (677.1 stems/ha, 31.4 m^2/ha, S = 23, H'= 2.13). Further studies are underway to determine the relationships between vegetation and environment.

2:15 THE EFFECTS OF TEMPERATURE AND SEASONAL CHANGE ON THE GERMINATION OF SALT MARSH SPECIES ALONG A SALINITY GRADIENT. **TODD P. EGAN AND IRWIN A. UNGAR, OHIO UNIVERSITY, DEPT OF ENVIRONMENTAL AND PLANT BIOLOGY, ATHENS OH 45701.**

The purpose of this experiment was to determine if seasonal temperature changes interact with salinity concentration to inhibit germination. Soil cores (6.0 cm diameter 7.5 cm deep) were collected from a salt marsh in Rittman, Ohio during the months of April, June, and October and placed in temperature treatments of 5:15°C, 5:25°C, 15:25°C, and 25:35°C. Seeds were allowed to germinate for 8-10 weeks and the seeds that did not germinate were counted from a 2.2 cm diameter sub-sample. Results demonstrated that for *Salicornia europaea* and *Atriplex prostrata* the total number of seeds that germinated decreased throughout the growing season. The number of ungerminated seeds decreased throughout the course of the year for *Atriplex prostrata*, but for *Salicornia europaea* the number of ungerminated seeds increased from April to June and decreased from June to October. For *Salicornia europaea* and *Atriplex prostrata* the ratio of germinated to total seeds decreased from April to June and increased from June to October. Over the course of the growing season and at all salinities the 5:25°C temperature treatment was the most stimulatory to seed germination. We suspect that a flooding event in June that killed the standing vegetation may have reduced soil salinity and allowed more seeds to germinate than usual over the course of a growing season.

2:30 VIABILITY AND GERMINATION OF *PAULOWNIA TOMENTOSA* SEED IN HABITATS COMMON TO SOUTHEAST OHIO. **A. CHRISTINA WILLIAMS AND BRIAN C. MCCARTHY, OHIO UNIVERSITY, DEPT OF ENVIRONMENTAL AND PLANT BIOLOGY, ATHENS OH 45701.**

Paulownia tomentosa is a tree, native to Asia, which has become naturalized throughout the southeastern US. Each infructescence can produce thousands of seeds. It is not known if this species can form a seed bank or if seeds must germinate after their release from capsules in winter. To address this question, we placed 100 seeds in nylon mesh bags in the field in early January into three replicates of mature forest, aggrading clear cuts, and forest edge. Bags were placed beneath litter and also at a depth of 5 cm in soil. Bags were harvested in mid and late summer. Seeds were removed from the bags, counted, and allowed to germinate on filter paper in a germination chamber (12/12, L/D; 25/15 C). Seeds that did not germinate were tested for viability using a tetrazolium test. Seeds germinated readily after burial from January to June. There was no difference in depth of seeds or habitat. The realized germination did vary with habitat in the late summer harvest. Virtually all of the seeds recovered from edge sites remained dormant (but viable). This suggests that there may be plasticity in the germination response depending upon field conditions and that seed bank formation is at least possible. A long term study is in place to determine how many years seeds can remain viable.

2:45 ABOVEGROUND VEGETATION, SEED BANK, AND SOIL ANALYSIS OF A 31-YEAR-OLD TREE PLANTING ON COAL MINE SPOIL IN MINKERS RUN, ATHENS COUNTY, OHIO. **CHRISTY L. TUCKER CARTER AND IRWIN A. UNGAR, OHIO UNIVERSITY, MSES PROGRAM AND DEPT OF ENVIRONMENTAL AND PLANT BIOLOGY, ATHENS OH 45701.**

Aboveground vegetation (% survival of trees; herbaceous cover) seed bank composition, and soil chemistry were assessed on a 31-year-old tree planting on coal mine spoil in 1997. A 47-year-old bare spoil area (control site) was also assessed for seeds and soil chemistry. Soils were analyzed for pH, CEC, % soil moisture, Cl^-, SO_4^{2-}, NO_3^-, P, K^+, Ca^{2+}, and Mg^{2+}. Percent survival of planted trees (>100%, 50-100%, and <50%) was represented by four, six, and four species, respectively. Ten volunteer tree species and 39 herbaceous species were found on the planted site, but none occurred in the control site. Percent similarity between the seed bank (representing two seed bank collections) and aboveground herbaceous vegetation was 9.8% and 8.2%, respectively, indicating that the seed bank differed significantly from the aboveground vegetation. No seeds at all were found in soil samples collected from the control site. Values for P, CEC, and SO_4^{2-} were significantly higher ($P<0.05$) while the remaining soil values were significantly lower in the control site. Tree plantings were found to alter soil and site characteristics, thereby promoting herb and tree establishment and accelerating the process of plant succession in spoil bank habitats.

3:00 THE RELATIONSHIP BETWEEN THE SOIL SEED BANK AND ABOVEGROUND VEGETATION IN DYSART WOODS, AN OLD-GROWTH MIXED MESOPHYTIC FOREST. **JILL E. BROWN AND BRIAN C. MCCARTHY, OHIO UNIVERSITY, DEPT OF ENVIRONMENTAL & PLANT BIOLOGY, ATHENS OH 45701.**

Seeds buried in the soil are known to play an important role in the structure and dynamics of many types of plant communities. However, forest habitats remain poorly studied. Certain vegetation types, such as mixed mesophytic, have been largely ignored. The purpose of our study was to examine the soil seed bank of an old-growth mixed mesophytic forest in eastern Ohio and to compare the seed bank composition with the aboveground vegetation. In February 1998, 500 cm^3 soil samples were collected from 35 permanent plots on both a north- and south-facing slope (70 total). Soil samples were returned to the lab, sifted to remove rhizomes, and transferred to germination flats in the greenhouse. Seeds were allowed to germinate (up to 180 days) and all species were identified using the nomenclature of Gleason and Cronquist (1991). On the north-facing slope, 41 species were found in the seed bank and 30 in the vegetation (only 8 of these were in common). On the south-facing slopes 46 species were found in the seed bank and 41 in the vegetation (only 12 of these were in common). Cluster analyses using Sorenson's similarity coefficient revealed a relatively high degree of dissimilarity between aboveground vegetation and belowground seeds and between slope aspects. These results confirm previous observations that the soil seed bank often diverges from the vegetation. However, the seed bank of Dysart Woods is unusually diverse compared to other old-growth forests in the region.

3:15 INTERNAL TRANSCRIBED SPACER DNA SEQUENCES RESOLVE TAXONOMIC CONUNDRUMS IN ASIAN VIOLETS (*VIOLA*). **HARVEY E. BALLARD, JR., KEN INOUE, AND KENNETH J. SYTSMA, OHIO UNIVERSITY, ENVIRONMENTAL AND PLANT BIOLOGY DEPT, ATHENS OH 45701.**

The Asian violet flora has long been plagued by questionable species distinctions, uncertain affinities of aberrant species, and a poor understanding of relationships among its several stemless groups. Morphological features and chromosome numbers alone have failed to resolve these taxonomic problems. These issues were explored with parsimony and maximum likelihood analyses of Internal Transcribed Spacer (ITS) DNA sequences for ca. 30 Asian Viola species and 50 species representing other infrageneric groups worldwide. Taxon pairs *V. iwagawai/tashiroi* and *V. chaerophyllum/eizanensis*, often considered conspecific, showed substantial sequence divergence, suggesting the need for further study. Molecular data resolved placement of the problematic species and grouped most stemless Asian violets, other stemless Holarctic groups and the stemmed Asian Bilobatae into one clade with tetraploid (x = 12) base chromosome numbers.

3:30 AN EMERGING PHYLOGENY OF THE GENUS *CUPHEA* (LYTHRACEAE) BASED ON INTERNAL TRANSCRIBED SPACER (ITS) DATA. **MELISSA A. LUKER, (SHIRLEY A. GRAHAM AND JOHN V. FREUDENSTEIN), KENT STATE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, PO BOX 5190, KENT OH 44242-0001.**

Currently the genus *Cuphea* comprises thirteen sections with ca. 260 species. The sections, originally defined by Koehne in 1903, are based on one to a few "key" morphological characters. Internal transcribed spacer (ITS) sequences representing each of the few sections are being generated using PCR methods and automatic sequencing to test their naturalness. Preliminary phylogenetic relationships are hypothesized from parsimony analysis employing PAUP* software. Initial data from eight of the thirteen sections suggests that the sectional boundaries are artificial. For example, species of section *Brachyandra* appear in at least three different clades together

with species of other sections. Additional sequences representing all of the sections are expected to elucidate major lineages in the genus.

3:45 GENETIC DIVERSITY AND BIOGEOGRAPHIC AFFINITY OF THE STATE ENDANGERED *FROELICHIA FLORIDANA* INFERRED FROM INTER-SIMPLE SEQUENCE REPEAT (ISSR) MARKERS. Ross A. McCauley, Harvey E. Ballard and Irwin A. Ungar, Ohio University, Dept of Environmental and Plant Biology, Athens OH 45701.

Froelichia floridana (Nutt.) Moq. var. *campestris* (Small) Fern (Amaranthaceae), is a state endangered herb restricted to one small population on a sandy terrace above the Ohio River in Washington Co. Ohio. This occurrence is a disjunction from the main species range from Texas through the central plains to Minnesota and northwest Indiana with a branch extending along the Gulf and Atlantic coasts. This Ohio occurrence suggests a once wider species range, a natural expansion, or a recent introduction. The later would expectedly result in a very low level of overall gene diversity; in any case low genetic diversity could pose concerns for long-term conservation. Genetic markers from inter-simple sequence repeats (ISSR's) were used to compare the Ohio population with populations from the southern Great Lakes, central Mississippi river drainage, Ozark plateau and Atlantic coastal plain. The Ohio population shows comparable levels of genetic diversity, refuting the hypothesis of a single recent introduction. Genetic similarities suggest a close affinity between Ohio and south-central U.S. populations.

4:00 REPRODUCTIVE BIOLOGY OF *PEDICULARIS* IN THE CHINESE HIMALAYA. Lazarus Walter Macior, Tang Ya and Zhang Jianshen, University of Akron, Dept of Biology, Akron OH 44325-3908.

A continuing study in 1998 of the pollination ecology of *Pedicularis* in the Chinese Himalaya corroborated prior data and, by insect exclosure, examined the dependence of plants on insect pollinators. A total of 234 (35 queen, 199 worker) *Bombus* pollinators was observed on 9 of 11 *Pedicularis* species. Visual and videotape observations confirmed that rostrate, nectarless, long- and short-tubed flowers are pollinated sternotribically by pollen-foragers, while short-tubed, erostrate, nectariferous flowers are pollinated nototribically and sternotribically by nectar- and pollen-foragers. No evidence was found for lepidopteran pollination of the nectarless, long-tubed flowers of *P. bidentata*, *P. cranolopha* and *P. longiflora* var. *tubiformis*. Microscopic analysis of corbicular pollen loads of 43 pollinators suggested that *Pedicularis* pollinators are monolectic or oligolectic. No evidence was found for specific and exclusive association of plant and pollinator species. During 212 man-hours of study of 11 *Pedicularis* species, observed pollinator frequency on single species never exceeded 3.0/hr. even on *P. longiflora* var. *tubiformis*, which formed very large, dense masses of bloom. Plants of *P. longiflora* var. *tubiformis*, *P. roylei* and *P. verticillata* from which insects were excluded produced no seed. These species plus *P. polyodonta* and *P. spicata* fruited abundantly (37-94%) when open-pollinated. The diversity of floral forms in Himalayan *Pedicularis* species is considered related to the behavioral dynamics of their virtually exclusive *Bombus* pollinators.

4:15 HARRY DIETRICH LUBRECHT AND HIS OHIO BOTANICAL CONNECTIONS. William R. Burk, University of North Carolina, John N. Couch Biology Library, CB#3280 Coker Hall, Chapel Hill NC 27599-3280.

Heinz (Harry) Dietrich Lubrecht (1908-1997), botanical and natural history bookseller, antiquarian book expert, and former executive of the publishing firm, Stechert-Hafner, had noteworthy botanical connections to Ohio. During the 1960s and early 1970s Harry focussed attention on reprinting natural history books within the firm's subsidiary, Hafner Publishing Company. He recommended the facsimile reprint of *The Deciduous Forests of Eastern North America*, by Ohioan botanist and ecologist, E. Lucy Braun (1889-1971). Originally published in 1950, this classic in phytogeography has been reprinted by Hafner four times (1964, 1967, 1972, and 1974). On 30 November 1973, Harry retired from Stechert and in December 1974 he founded his own business, Lubrecht & Cramer, Booksellers and Publishers. During his career he found many historically significant books through his book scouting ventures, especially in Europe, and contacts in the antiquarian book market. Emanuel D. Rudolph (1927-1992), professor of botany at The Ohio State University, became a friend of Harry through his book collecting and association at botanical conferences. With Rudolph's suggestion and encouragement, the OSU Libraries in Columbus acquired (October 1983) 16 titles from Lubrecht's impressive collection of works by Carl Linnaeus (1707-1778), great eighteenth century naturalist of Sweden, dating from 1737 to 1784, and among them two by Linnaeus' students. At the OSU campus a series of events, highlighted with presentations by botanists and an exhibit of the Linnaean books in the atrium of the main library, celebrated (25, 26 April 1984) this extraordinary purchase.

4:30 COMPARISON OF FIELD BOTANICAL EXPLORATION BY C. S. RAFINESQUE (1818-1826) AND C. W. SHORT (1833-1840) IN THE OHIO VALLEY, PARTICULARLY KENTUCKY. Ronald L. Stuckey, Ohio State University, Museum of Biological Diversity, Columbus OH 43212-1192.

Recently prepared dot maps mark the localities where the pioneer nineteenth century botanists, C. S. Rafinesque and C. W. Short obtained plants in the field and preserved them for their personal study herbaria. Headquartered at Transylvania University in Lexington, both botanists explored that area northward to Cincinnati, eastward to the Olympian Springs, and southward along the Rockcastle River. Rafinesque extended his southern trip farther south into the falls region of the Cumberland River. Each botanist made two excursions into the western part of Kentucky— Rafinesque's (1818, 1819) were more extensive than Short's (1838, 1840). Rafinesque came through Ohio (1826); Short studied the prairie flora of Illinois (1837). The maps reveal that Rafinesque traveled more widely throughout the Ohio Valley than did Short in a comparable seven-eight years period. Short's botanical legacy, however, carries much more credibility than does Rafinesque's. This measure is based on the excellent quality of Short's carefully prepared specimens and the more accessible, thoroughly written contents of his substantially fewer botanical publications.

4:45 A PERMINERALIZED WOOD OF A NEW ARCHAEOPTERIS TREE FROM THE LATE DEVONIAN CLEVELAND SHALE OF OHIO. Shya Chitaley, Cleveland Museum of Natural History, 1 Wade Oval Dr, University Circle, Cleveland OH 44106-1767.

During the construction work in 1965-68, of interstate I-71 through Cleveland, Ohio, many plant fossils of varied affinity were salvaged from the freshly exposed black shale of the Late Devonian age. Most of the fossils are compressions of big trunks and large fertile cones of lycopsids, indicating their dominance in the Cleveland Shale flora of the Late Devonian forest of Ohio. The present permineralized piece of wood collected from the grayish black silty shale adds to the biodiversity of the extinct forest. It is of a pro-gymnospermous tree *Archaeopteris* and is a piece of its trunk called *Callixylon*. The piece being tolerably well preserved is studied under light microscope after preparing thin sections on a cellulose acetate film using peel technique. Anatomically it shows both primary and secondary details of tissues. When compared with the known species of the genus *Callixylon* Zalessky, it is found that it differs from all of them in characters of importance and so warrants the creation of a new species to be described in another publication.

Plant Physiology

09:00AM Saturday, April 24, 1999

Main Classroom Bldg. - 104

Carolyn J. McQuattie - Presiding

9:00 HISTORIC LAND USE AND ITS IMPACT ON LEAF NITROGEN CONCENTRATION AND POTOSYNTHETIC RESPONSE. Elizabeth A. Nastari, Mount Union College, 1972 Clark Ave, Alliance OH 44601.

The purpose of this study was to test whether or not historic land use had an impact on Nitrogen (N) concentration in the leaves of forest floor plant species and if the concentration would in turn affect photosynthetic response. The hypothesis was: Increased land use decreases the leaf N concentration resulting in plants with higher concentrations having more efficient photosynthetic response. Data for this experiment was collected across three sites representing land use histories of plowed, pasture, and undisturbed woodlot at the Harvard Forest in Petersham, Mass. This project examined five species: *Aralia nudicalis, Clintonia borealis, Medeola virginiana, Acer rubrum* and *Quercus rubra*. After collection, leaf area was determined by a Li-cor 3000A scanner then dried and weighed and analyzed by a Fison 1500 CHN analyzer to determine average N concentration ($\mu gN/cm^2$) in each plant. The N concentration was then compared to light response curves ($\mu mol\ CO_2/m^2/sec$ vs. $\mu mol\ photons/m^2/sec$) and CO_2 response curves ($\mu mol\ CO_2/m^2/sec$ vs. $\mu mol\ CO_2/m^2/sec$) as taken with a Li-cor 6400. The results indicated no significant differences or correlation in mean leaf N concentration and photosynthetic response across the three sites to changes in CO_2 or light..

9:15 LEAF ANATOMY OF DIFFERENT-AGED SUGAR MAPLE TREES FROM FOUR GEOGRAPHIC SOURCES. Carolyn J. McQuattie and Amy J. Scherzer, USDA Forest Service, 359 Main Rd, Delaware OH 43015.

To determine how age, genotype, and canopy position affect leaf anatomy of sugar maple (*Acer saccharum* Marsh.), leaves were collected from 36-year-old grafted sugar maples from OH, VT, MA, and NY (Site 1, Apple Creek, OH) and 9-year-old half-sib progeny (Site 2, Malabar Farm, OH) from the same 4 sources. Leaves from trees at Site 1 were stratified into upper and lower canopy. Leaf blade sections were chemically fixed, dehydrated, and embedded in epoxy resin prior to examination by light and electron microscopy. For each genotype at Site 1, upper canopy leaves were thicker than lower canopy leaves due to increased thickness of the palisade cell layer. For each genotype at Site 2, leaf thickness was similar to lower canopy leaves at Site 1. Leaves with greater sun exposure (upper canopy, Site 1; all leaves, Site 2) had increased phenolic compounds in mesophyll cell vacuoles and decreased numbers of thylakoid grana stacks in mesophyll chloroplasts. Large starch grains were seen in mesophyll cell chloroplasts in all leaves from Site 2. In contrast, at Site 1 no starch was seen in chloroplasts from any upper canopy leaves, and only occasional starch grains were observed in lower canopy leaves. Leaf anatomical characteristics of all genotypes were affected similarly by tree age and canopy position.

9:30 ISOLATION OF A NEW MAIZE VIRUS. R. Louie, J. Abt, M.G. Redinbaugh, D.T. Gordon, and O.E. Bradfute, USDA-ARS, OARDC-OSU, 1680 Madison Ave, Wooster OH 44691.

An unknown virus (UkV) was isolated from maize (*Zea mays*) leaves from Arizona showing mild mosaic symptoms and co-infected with maize dwarf mosaic virus (MDMV). A pure culture of UkV was obtained following serial transmission by vascular puncture inoculation of Seneca Chief sweetcorn kernels. Symptoms on leaves of the latter included pale green to chlorotic spots and streaks (1-5 mm) over secondary veins that developed into large spindle-shaped rings (>20 mm). The rings sometimes became necrotic and coalesced with rings from adjacent veins. Necrosis also occurred on leaf sheaths. Pioneer hybrid 3379 and 'Spirit' sweetcorn were also susceptible to the virus. UkV was not transmitted by *Myzus persicae*, *Rhopalosiphum padi*, *Graminella nigrifrons* or *Dalbulus maidis* when tested for nonpersistent or persistent transmission nor by rub inoculation of maize inbred Oh28, *Triticum aestivum* 'Freedom' and *Sorghum bicolor* 'Atlas'. UkV

was purified by differential centrifugation followed by rate zonal and density gradient centrifugation in sucrose and cesium, respectively. It has an isometric particle (ca 32 nm dia), a putative 31 kDa coat protein and a RNAse sensitive nucleic acid of ca 4.3 kb. The virus did not react with antisera to MDMV, maize chlorotic dwarf, maize stripe or maize white line mosaic viruses in $F(ab')_2$ ELISA. UkV is conditionally named maize necrotic streak virus.

9:45 EFFECTS OF FERTILIZER ON RAPID INDUCED RESISTANCE IN *POPULUS NIGRA* TO *LYMANTRIA DISPAR* AND *ORYGIA LEUCOSTIGMA*. MARIE H. EGAWA, (DR. DANIEL HERMS, DR. MARGARET HODGE), COLLEGE OF WOOSTER, BOX C-1535, WOOSTER OH 44691.

Previous research has demonstrated that plants exhibit constitutive resistance to herbivores, a response expressed throughout the life of a plant. Recent studies have shown that another type of resistance, induced resistance, occurs in plants after herbivore attack. Effects of induced resistance on insect performance (growth rate, consumption rate) and plant physiology (growth rate, nutrient uptake, secondary metabolites) are not well understood. In particular, the relationship between environmental stress and induced resistance has yet to be fully explored. Fast-growing trees have been found to produce faster resistance responses. These results support the Growth / Differentiation Balance theory that predicts a correlation between resistance response and developmental constraints in plants. Therefore, it was hypothesized that induced resistance would be stronger in fast-growing plants. Commercial nutrient fertilizer was chosen as the environmental variable in a plant-herbivore system of poplar to gypsy moth and white-marked tussock moth. A high and low level of nitrogen fertilizer was used and half of the plants were defoliated. Larval bioassays were then conducted to measure herbivore performance and to determine whether plants expressed induced resistance. Preliminary results have yielded evidence in support of the hypothesis. High nutrient environments of poplar trees elicit induced resistance to gypsy moth.

10:00 A MUTANT COMMON BEAN (*PHASEOLUS VULGARIS*) WITH THE ABILITY TO RESTRICT NODULATION BY *RHIZOBIUM* STRAINS. SARAH L. BASHORE AND ART T. TRESE, OHIO UNIVERSITY, DEPT OF ENVIRONMENTAL AND PLANT BIOLOGY, PORTER HALL, ATHENS OH 45701.

Rhizobium species form a symbiosis with leguminous plants. The bacteria fix nitrogen for the plant and the plant in turn provides the bacteria with energy and protection. *Rhizobium* classification is determined by the host range of the strain. Three species of *Rhizobium*, *Rhizobium leguminosarum*, *Rhizobium etli*, and *Rhizobium tropici*, are known to nodulate *Phaseolus vulgaris*. To overcome low occupancy of inoculant strains, a bean plant that limits nodulation to specific species of *Rhizobium* is needed. A mutant of *P. vulgaris* was found that restricts nodulation among these three species of *Rhizobium*. Eighteen strains of *Rhizobium* were inoculated onto the mutant bean plant. Three of the strains were found to overcome the restriction and nodulate the mutant bean plant. These species that are able to nodulate do not correlate with the classification system that has been determined. Currently, more species of *Rhizobium* are being examined by inoculation for their ability to overcome the restriction of nodulation by the mutant *P. vulgaris*.

10:15 THE HALF CALMODULIN GENE: A STUDY OF THE MINIMAL STRUCTURAL REQUIREMENTS FOR CALMODULIN *IN VIVO* FUNCTION IN *PARAMECIUM TETRAURELIA*. EMILY M. HENDEL, PHILLIP A. VERHOFF, ROBERT D. HINRICHSEN, (DEAN M. FRAGA), COLLEGE OF WOOSTER, BOX C-1821, WOOSTER OH 44691.

Calmodulin is a calcium binding protein involved in the regulation of cellular responses. The calmodulin molecule is made up of two structural domains, the carboxy- and amino-terminal halves, each containing two calcium binding sites. The binding of calcium at these sites forms an activated calcium/calmodulin complex that interacts with a variety of target proteins. Because the two domains of the calmodulin molecule exhibit a high degree of homology, it was speculated that the protein might have some structural redundancies making it possible that some cell functions might depend on the expression of only one half of the protein. Work done in *Paramecium* by Hinrichsen and colleagues has demonstrated that calmodulin genes exhibiting deactivation of calcium binding sites in the amino-terminal domain are able to complement mutations in the carboxy-terminal domain of an endogenous calmodulin gene. If calcium binding in the amino-terminal domain is unnecessary, then it may be possible that the complementation of the endogenous mutation might require only one half of the calmodulin gene. This speculation is supported by Sun et al. whose work demonstrated that independent half calmodulin constructs are able to complement deletion mutants and restore normal function to yeast cells. The focus of this study is to further investigate the complementation abilities of the independent half calmodulin genes *in vivo*. Expression vectors containing the independent halves of the calmodulin gene have been constructed for *Paramecium*. Currently these constructs are being used in the transformation of behavioral mutants via microinjection at high concentrations in an attempt to achieve an observable complementation of the mutation. The results to date have shown that the construct containing the carboxy-terminal half calmodulin gene is unable to restore normal behavior to cells having a mutation in the corresponding half of the endogenous gene. This may indicate that the deleted amino-terminal half of the gene has an essential structural function in complementation that may not be calcium dependent. The construct containing the amino-terminal half calmodulin gene has not yet been tested.

EXPERIMENTAL PHYSIOLOGY; HORMONAL MODULATORY MECHANISMS

09:00AM SATURDAY, APRIL 24, 1999

MAIN CLASSROOM BLDG. - 105

LEE A. MESERVE - PRESIDING

9:00 DOSE RESPONSIVENESS OF AN IMPLANTABLE TESTOSTERONE DELIVERY SYSTEM. MICHAEL HERMAN, HAMID DANESHVAR, GAIL DUNPHY, DANIEL ELY, UNIVERSITY OF AKRON, DEPT OF BIOLOGY, AKRON OH 44325-3908.

The delivery of steroids to animals over a long period of time is not practical by standard injection techniques. A steady-state release of steroids that minimizes handling of the animal is preferred. For many years, investigators have implanted a silicone tube that allows a gradual diffusion of the steroid. However, the actual level of the steroid was unknown. The literature reports the levels are "physiologic". Therefore, the objective of this study was to determine the serum level of testosterone (T) using 3 different lengths of silicone tubing (19, 12, 6 mm) of the same diameter (0.062mm). Eight SHR rats were castrated, and every 2 weeks following, the respective tubes were subcutaneously placed in the neck region and stapled. Each tube was left in for 1 week, after which the tube was removed and a blood sample was taken for T measurement by RIA (Bio Rad). Before implanting the next tube, a control blood sample was taken. In our study, the standard length reported in the literature (19 mm) produced a serum T of 24 ng/ml ± 4, the 12 mm produced a serum T of 15 ng/ml ± 3, and the 6 mm produced a serum T of 7 ng/ml ± 2. In conclusion, the standard length is excessive and gives an exaggerated T level. The recommended physiological length to replace T after castration appears to be 6 mm (supported by HL#48072-05).

9:15 A NEW TECHNIQUE TO STUDY ISOLATED TESTICULAR FUNCTION. HAMID DANESHVAR, BEI LIU, GAIL DUNPHY, DANIEL ELY, UNIVERSITY OF AKRON, DEPT OF BIOLOGY, AKRON OH 44325-3908.

Work in our laboratory has found that the Y chromosome and testosterone interact to increase blood pressure in the spontaneously hypertensive rat (SHR). In this study, an in vivo technique was developed to isolate and perfuse the rat testes by ligating the surrounding vessels and then cannulating the dorsal aorta. Oxygenated Krebs-Henseleit solution was delivered at 1 ml/min and 80 mmHg pressure using a roller pump. When steady state was reached, perfusate was collected following 2 types of stimulation: electrical shock and luteinizing hormone (LH) infusion (0.15 µg/ml). Perfusate was analyzed for the release of testosterone (T) by RIA (Bio Rad), and norepinephrine (NE) levels by HPLC with electrochemical detection. Levels of T for a control period were about 6 ng/ml (±0.3) and held steady for 30 min. with samples taken every 2 min. Electrical stimulation of the spermatic nerve resulted in a significant ($p<0.01$) elevation of perfusate effluent NE but not T. However, LH treatment significantly ($p<0.05$) increased T levels by about 50% returning control levels after 15 min. In conclusion, the above in vivo technique functioned successfully responded to LH stimulation with T release, and could be used for comparison different treatments and strains of rats (supported by HL#48072-05).

9:30 THE EFFECTS OF GENDER AND MENSTRUAL PHASE ON CARBOHYDRATE UTILIZATION DURING COLD AIR EXPOSURE. THOMAS J. SCHARSCHMIDT (DR. ELLEN GLICKMAN-WEISS), KENT STATE UNIVERSITY, KENT OH 44242.

Previous research has suggested that males and females utilize carbohydrate (CHO) at different rates during exercise. The purpose of this study is to evaluate the effects of gender and menstrual cycle on the rate of CHO utilization during cold air stress (5°C). This study examined whether this differential response is replicated during a submaximal elevation in metabolism as demonstrated during thermogenesis (i.e., shivering during cold air exposure). Presently, male and female subjects are being recruited between the ages of 18-29 yr. Women must not be on a contraceptive and must menstruate normally. Following a 30 min. baseline period, subjects sit will in an environmental chamber maintained at 5°C wearing a cotton bathing suit for 90 min. However, trials will be terminated if esophageal temperature (T_{es}) becomes ≤35°C. Females will undergo the experimental trial twice; once during the follicular phase and once during the luteal phase of their menstrual cycle. The following variables will be measured: respiratory quotient (RQ), ventilatory equivalent (V_E), heat production (M), insulation effect (I), T_{es}, skin temperature (T_{sk}; average of head, chest, triceps, hand, thigh, calf, foot), thermal sensation (TS), heart rate (HR), and percent of energy derived from CHO. ANOVA will be utilized to test between group differences across time.

9:45 THE EFFECTS OF MELATONIN ON CELL SHAPE. ELIZABETH A. CARROLL AND MELISSA A. MELAN PHD, DUSQUESNE UNIVERSITY, DEPT OF BIOLOGICAL SCIENCES, PITTSBURGH PA 15282.

Melatonin (MEL) aids in numerous physiological functions, such as sleep, but its cellular effects are largely unknown. We investigated the effects of melatonin on the arrangement of the microtubule cytoskeleton of transformed Chinese Hamster Ovary (CHO) cells. Two membrane-bound MEL receptors have been identified- mt 1, which has a high affinity for MEL, and MT 2, which has a lower affinity. Two lines of transformed CHO cells that express human MEL receptors were created to assess MEL receptor function. Upon treatment with 1 µM MEL, only mt 1-CHO cells produce neurite-like outgrowths. When treated with MEL and colcemid, an antimitotic drug, mt 1-CHO cells no longer produce outgrowths. Upon UV photoreversal of colcemid, monopolar outgrowths are observed. To determine if outgrowths are sustained after removal of MEL, cells

from each line were treated for 5 hours. Then their media was replaced without MEL. Cells were treated with cycloheximide, a compound that inhibits protein synthesis, to determine if outgrowth formation depends upon gene expression. Cells were also treated with varying concentrations of KT5720, a compound that inhibits cAMP-dependent protein kinase A activity. Preliminary results show that 0.06 μM KT5720 enhances the effects of melatonin. The long-term results of the study will lead to greater understanding of the mechanisms that regulate neurite growth and may lead to therapies for CNS trauma.

10:00 EFFECTS OF THREE ISOCALORIC DIETS AND VASOPRESSIN ON CIRCADIAN RHYTHMS IN MALE RATS. **Kristi L. Smiley, Cyrilla H. Wideman, and Helen M. Murphy, John Carroll University, Dept of Biology, 20700 N Park Blvd, Cleveland OH 44118.**

The suprachiasmatic nucleus (SCN) of the hypothalamus has been shown to play a role in maintaining circadian rhythms in rats, The SCN utilizes the light/dark cycle in synchronizing circadian rhythms. Vasopressin-containing neurons, found in the SCN have been known to possess an endogenous rhythm which can be correlated with the environmental light/dark cycle. Because the SCN also acts as a center which sustains metabolism, thereby affecting the utilization of carbohydrates, fats, and proteins, it is of interest whether vasopressin has a role in this process. Utilizing biotelemetry, circadian body temperature (BT) and activity (AC) were monitored in vasopressin-containing, Long-Evans (LE) rats and vasopressin-deficient Brattleboro (DI) rats, where the LE rats served as the controls. During the habituation period, all rats were provided with a standard chow and water ad-libitum, while being exposed to a 12h/12h light/dark cycle. The experimental period differed in that each of three groups of 6 LE and 6 DI rats (n=36) were fed either a high-fat, high-protein, or high-carbohydrate diet. Throughout the entire experiment, both LE and DI rats displayed higher nocturnal BT and AC. In the light phase, markedly depressed BT was shown by the DI rats at different weeks in the experimental period, depending on the diet given. Because the DI rats lack vasopressin, their circadian BT and AC were affected due to nutrient quality which is ultimately related to differences in metabolism. Therefore, the presence of vasopressin does have a role to play in nutrient utilization.

10:15 EFFECTS OF EXPOSURE TO POLYCHLORINATED BYPHENYL (PCB) FROM CONCEPTION ON REVERSAL LEARNING IN SPRAGUE DAWLEY RATS. **Terri L. Provost, Marin Felic, Laura Juárez de Ku, Lee A. Meserve, Bowling Green State University, Dept of Biological Sciences, Bowling Green OH 43403.**

Polychlorinated biphenyls (PCB) are environmental contaminants that cause alterations in cognitive ability in human and rat offspring. Exposure to mixtures of PCB congeners during gestation and lactation causes alterations in choline acetyltransferase activity, dopamine concentrations, and Morris water maze learning ability. However, there is evidence that the spatial orientation, determined by placement of chlorine atoms, is a determinant of effects of individual PCB congeners. PCB 77 is a pentachlorinated congener with substitution at the 3,3',4,4' carbons giving a coplanar orientation. In the present study, rat pups were exposed to 12.5 ppm of PCB 77 from conception through termination. From 25 days of age through termination at day 30, the pups were subjected to Morris water maze trials to test learning and relearning ability in placement of a submerged hidden platform to escape the water. The test included 10 trials for initial learning and 5 trials for reversal learning. Previously reported data from our lab indicated that rats exposed to PCB 77 performed subnormally in the initial learning task (first 10 trials). The new data revealing relearning ability indicate that the PCB exposed animals perform the task less well than PCB-free animals. The relearning curve of latency time to the podium required was as expected for control animals with less time to the podium for each subsequent trial. The PCB exposed animals demonstrated in both time and latency to the podium over retraining trials. This suggests that PCB 77 affects neurological ability in acquisition of knowledge as represented in the first ten Morris water maze trials and in reversal learning as is represented in the relearning trials.

Experimental Physiology; Other

02:00PM Saturday, April 24, 1999

Main Classroom Bldg. - 105

Judy Adams - Presiding

2:00 THE USE OF MUSIC THERAPY TO REDUCE AGITATION BEHAVIOR IN ALZHEIMER PATIENTS IN A NURSING HOME SETTING. **Rebecca A Stanhope, Atrium I Nursing and Rehabilitation Center, 5180 Campbells Run Rd, Pittsburgh PA 15205 and Kenneth A. LaSota, Robert Morris College, Dept of Natural Sciences, 600 Fifth Ave, Pittsburgh PA 15219-3099.**

This study examined the effectiveness of low, melodious sounds on calming the agitated behavior of residentially housed Alzheimer patients. Five ambulatory residents aged 70 to 85 with Mini-Mental-State (MMS) scores of 17 or less were observed for three weeks over the noon lunch hour from 10:30am to 1:30pm in the common dining/social area of their unit. A total of 701 agitated behaviors were documented, such as: excessive wandering, auditory agnosia, hitting, abulia, vulgarism, etc. Residents' behavior was again monitored for three weeks with the application of background music from the "Brain Wave Suite" collection produced by the Relaxation Company. A total of 583 agitated behaviors were observed, approximately a 17% drop. Given the scope of the study and the anecdotal evidence from facility staff members the results suggest marked improvement occurred in the overall quality of life of the residents and in the general working conditions within the area of the facility involved. Staff comments indicated that residents were happier, ate more, and were easier to work with after using the music therapy. The final results indicated a better situation existed on the unit after the application of the music regime.

2:15 A SURVEY OF CHIROPRACTORS' USE OF NUTRITION AND EXERCISE IN PRIVATE PRACTICE. **Dean L. Smith D.C., Diana M. Spillman PhD, Miami University, 130 Phillips Hall, Oxford OH 45056.**

The purpose of this investigation was to assess chiropractors' use of nutrition and exercise in private practice along with their opinions of such practices. We utilized a random sample mail survey to practicing United States chiropractors. The response rate was 32% (69 of 217). Of those who responded, 78% were male; the mean number of years since graduation from chiropractic college was 13 years with a range from 1 year to 39 years. Eighty-six percent use exercise modalities in their practices. The average practice time spent on nutrition was 19% and exercise 26%. Fifty-one percent of responders felt that their chiropractic college provided them with an adequate understanding in nutrition. But eight-three percent incorporate nutritional counseling, distribute nutritional literature or recommend nutritional supplements. Forty-one percent agree that chiropractors are able to address all nutritional concerns and 20% feel that the services of a nutritional specialist should only be used for second opinion interpretations. Most chiropractors in our sample incorporate both nutritional and exercise services in their practice. The results of this study may assist future decision making regarding student chiropractic education and clinical use of nutrition and exercise.

2:30 THREE DIMENSIONAL CHANGES IN CRANIOFACIAL SOFT TISSUE OF TEN BOLTON FEMALE FACES USING BI-ORTHOGONAL CEPHALOGRAMS AND 3D CT IMAGES. **David Z. Martinez, 11915 Carlton Rd, Cleveland OH 44106.**

The goal of this study was to obtain three-dimensional soft tissue surface data representative of all females during the period of growth. From 1927-1959, sixteen males and sixteen females were asked to provide frontal and lateral plain film x-rays annually between the ages of three and eighteen. Collectively, this group of thirty-two individuals compiles a database known as the Bolton Standards. Recently, ten of these previously mentioned females have been recalled to provide normative bi-orthogonal cephalograms and current CT images. In a computer interface that produces a three-dimensional wire frame, twenty-one soft tissue landmarks have been digitized on each set of the female bi-orthogonal cephalograms. After this was achieved, within a similar interface the homologous soft tissue face landmarks have been digitized upon a three-dimensional surface generated by the stacking of individual CT slices. Via thin plate spline, the current CT image was then warped to the landmarks from a visit during the growth period producing a three dimensional surface representation of the female's face at a particular age of her childhood. After applying a malleable template of sixty-five landmarks to the warped soft tissue face three-dimensional CT images, a surface was generated. With respect to age, these individual surfaces have been combined to form average surfaces across all ten females studied. To date, well over one hundred three-dimensional surfaces have been created by warping current CT slice data and sets of female bi-orthogonal cephalograms. These individual surfaces have been combined to generate averages representative of all three, six and nine year olds. Even prior to plotting the results, the patterned migration of landmarks as years pass was clearly visible.

2:45 DETERMINATION OF THE FREQUENCY OF THE POLYMORPHIC E-CADHERIN PROMOTER IN THE GENERAL POPULATION. **Melicia R. Cottrill, (Dr. Cathie Smith and Dr. Robert DePhilip), Denison University, Slayter Box 616, Granville OH 43023.**

According to the National Breast Cancer Coalition, one in eight women will be diagnosed with breast cancer in her lifetime. To design better therapies for these patients, an understanding of the progression of a cell from a normal state to a malignant one and finally to metastasis is essential. To investigate factors involved in malignant cell mobility and metastatic potential, molecules essential in cell adhesion have been studied, for instance the E-cadherin protein. This molecule is an integral membrane protein involved in adjacent cell recognition and adherence. Loss of this protein is observed in several epithelial cell carcinomas like breast cancer. The current hypothesis is that loss of adhesion leads to tissue invasion and metastasis. Metastatic cells do not express the E-cadherin gene as either mRNA or protein, showing that gene expression is down-regulated in invasive cancers. To understand why the E-cadherin gene was no longer actively transcribed, the promoter of the gene was previously studied and two polymorphisms were found in breast cancer cell lines. Upon sequencing the wild type and polymorphic (or putative mutant) promoter, three point mutations were found. Therefore, since a mutation in the E-cadherin gene promoter has been identified in cancer tissue, ascertaining its frequency in the general population is necessary. Hypothetically, if a cell is heterozygous for this polymorphism, it may be more likely to metastasize after cellular transformation since E-cadherin levels may already be compromised. To determine the frequency, DNA was isolated (via the Proteinase K method) from 74 blood samples of normal medical students. PCR was performed with two sets of DNA primers specific for both the wild type and mutant E-cadherin promoter. Ten weeks of the past summer were spent in optimizing the PCR conditions for both primer sets. After many trials, the optimal conditions for the wild type primer set are 66°C annealing temperature and 0.5 mM Mg^{2+}. Optimizing the mutant reaction was more difficult and is currently under investigation. Once this reaction is optimized, the genotype of each student will be known yielding an estimate of the frequency of this polymorphism in the general population.

3:00 A NEW METHOD FOR DETERMINING ARGINASE ACTIVITY. **L. Messineo and N. Steiger, Cleveland State University, BGES Dept, 2399 Euclid Ave, Cleveland OH 44115.**

Data presented to the Ohio Academy of Science Meeting, 1998 showed a new modification of the Sakaguchi reaction which uses as the oxidizer agent sodium dichloro-s-triazinetrione dihydrate in the determination of arginine. More recent studies showed that the same methodology can be used for determining the amount of arginine in the presence of arginase. Thus the enzyme activity of arginase can also be determined. For example, 20 µg of arginine at time zero has an optical density of 0.960 at 520 nm and 0.575, 0.375 and 0.100 10, 30 and 90 minutes respectively after the addition of 2 µg. of arginase to the arginine solution. Since arginase converts the amount of arginine present in any sample, the decrease in arginine is shown by a decreasing optical density at 520 nm when this is plotted versus time expressed in minutes passed after the addition of arginase. This method, since it measures one of the remaining reactants, has a great advantage over other methods that measure enzyme activity by testing products and/or by-products because this method avoids by-product and allosteric inhibition.

3:15 CORONARY COLLAGEN IS ELEVATED BY THE PRESENCE OF THE Y CHROMOSOME FROM THE SPONTANEOUSLY HYPERTENSIVE RAT (SHR). **Darcie Seachrist, Daniel Ely, Changying Li, University of Akron, Dept of Biology, Akron OH 44325-3908.**

The Y chromosome (C) from an SHR rat produces increased blood pressure (BP) and an earlier testosterone (T) rise during puberty than the Y C from a normal BP rat (WKY). Hypertension and elevated T cause increased collagen deposition in arteries. Therefore, the objective of this study was to determine if the addition of the hypertensive Y C to a WKY genetic background or the removal of the hypertensive Y C from a SHR genetic background would alter BP and coronary collagen (CC). Colonies of 4 strains (SHR, WKY, SHR/a, SHR/y) of rats were established with 8 females and 8 males in each colony. Another set of 4 colonies were established using the same strains and put on clonidine. BP was measured weekly by tail cuff from 6-15 weeks of age and left ventricle was sectioned and stained with Sirius red. SHR had the highest amount of CC and WKY the least. Removal of the hypertensive Y C (SHR/a) reduced BP by 30mmHg and CC by 77% ($p<0.05$). Addition of the hypertensive Y C to the WKY (SHR/y) increased BP by 25mmHg and CC by 385% ($p<0.01$). Clonidine reduced BP in all strains and reduced CC in the SHR and SHR/y strains by 74% and 85% ($p<0.05$) respectively. In conclusion, the SHR Y C raises BP and CC and both can be prevented by clonidine (supported by HL #48072-5).

3:30 CHARACTERIZATION OF AN *Sry* GENE IN THE SPONTANEOUSLY HYPERTENSIVE RAT. **Christopher D. Codispoti, Daniel L. Ely, Monte E. Turner, Almir S. Martins, Amy Milsted, University of Akron, Dept of Biology, Akron OH 44325-3908.**

Male spontaneously hypertensive rats (SHR) have significantly higher blood pressure than Wistar-Kyoto (WKY) rats. Further, the males of both strains have higher blood pressures than females of the same strain. From experiments using these two strains of rats, we showed previously that there is a significant effect of the SHR Y-chromosome to hypertension. However, it is not known which locus causes this effect. A good candidate for this locus is *Sry*. This is because *Sry*: 1) is one of the few genes known to be on the rat Y-chromosome; 2) encodes a transcription factor that contains an HMG box (a DNA binding element); 3) is expressed early in development when the pattern for hypertension is established; and 4) is the testes determining factor. In an effort to find *Sry* in rats, our laboratory developed a genomic library from DNA from the livers of five SHR/y male rats. This library was screened with double-stranded DNA probe encoding the HMG box. A total of 14 genomic clones were isolated. One of these clones, S15, was chosen for characterization by restriction endonuclease mapping and sequencing. When S15 was digested with *Xba*I, seven distinct bands were seen. Each of these bands was ligated into pBluescript phagemid vector and transformed into supercompetent bacteria. For each of the seven subclones, a restriction map was generated using the enzymes *Xba*I, *Eco*RI, *Ava*II, and *Xho*I; all subclones were also sequenced. It was found that the entire coding sequence of the *Sry* gene, as well as the 3' untranslated region and a polyadenlyation signal were located on one subclone (subclone S15-2). This is the first report of the complete amino acid coding sequence and 3' untranslated region in *Rattus norvegicus*. Both SHR and WKY rats are members of this species.

3:45 EPIGENETIC EFFECTS IN HYPERTENSION. **Dianne E. Kirk, Monte E. Turner, Richard L. Londraville, Amy Milsted, University of Akron, Dept of Biology, Akron OH 44325-3908.**

DNA methylation of cytosines (C) acts as an epigenetic control of transcription that can affect how genes or sets of genes are expressed. Methylation is not a mutation but an acquired characteristic whose transmission to succeeding generations is well documented. We showed earlier that SHR/y and WKY female rats are genotypically identical but differ phenotypically. Although their genetic contents are the same, the SHR/y females have consistently higher blood pressures. Minimums of four DNA samples of ages 6, 10, and 16 weeks in each strain were analyzed. Alterations in genes were investigated through digestions with various restriction endonucleases. We developed an AR methylation assay for use in these studies. Genomic DNA was amplified by PCR to detect methylation at specific CG sequences within enzyme recognition sites. Androgen receptor PCR products from digestions exhibited two methylated fragments. Methylation at one site of the androgen receptor gene is the same in both SHR/y and WKY females. Methylation may be a control mechanism that varies at different times in development and may account for the phenotypic differences observed between female rats of these strains.

Science Education

09:00AM Saturday, April 24, 1999

Main Classroom Bldg. - 106

Mary D. Gahbauer - Presiding

9:00 DO WE ACTUALLY TEACH SCIENCE? **Mary D. Gahbauer, Otterbein College, Dept of Life and Earth Science, Main St, Westerville OH 43081.**

It was noticed that students did not apply criteria of scientific decision-making to matters outside class. A survey instrument was designed to determine: 1) attitudes of biology students to the use of non-pharmaceutical "health products", 2) familiarity with common terms in scientific reasoning, and 3) the students' ability to identify fallacies in scientific reasoning. Freshman majors and non-majors, and senior majors and non-majors were surveyed on two consecutive years. The faculty of the science division was also surveyed in order to determine whether aspects of scientific reasoning were discussed overtly or implicitly in class. Analysis of the results shows: 1) biology students are more receptive to "health products" than reason ought to allow, 2) students are overwhelmingly unfamiliar with some terms in scientific reasoning (and most faculty do not teach these terms explicitly), 3) the negative correlation between the number of science courses taken and the number of errors of reasoning made was only of borderline significance. Some fallacies of reasoning were more common than others. These results indicate a need for more explicit discussion of scientific reasoning in science courses.

9:15 GENDER DIFFERENCES IN SCIENCE CAREER CHOICES OF HIGH SCHOOL STUDENTS. **Soonhwa Yoo and Ayres G. D'Costa, Ohio State University, 310 Ramseyer Hall, 29 West Woodruff Ave, Columbus OH 43210.**

Women are under-represented in science, mathematics and technology careers. A cognitive theory-based hypothesis posits that self-efficacy beliefs, developed differentially in girls at the high school stage, may be responsible for not sufficiently encouraging their pursuit of a science career. Self-efficacy beliefs are formed as a result of social support and successful performance, and result in career-related interests and career choice. The research method used a set of career path analyses, using covariance structure modeling. Eight models were proposed and analyzed using short tests and questionnaire data gathered from 719 high school students in Ohio from 12 schools, with the support of The Ohio Academy of Science and the cooperation of local science teachers. The purpose was to compare career path differences between boys and girls so as to identify the roles of gender, academic performance, self-efficacy beliefs, career-related outcome expectations and interests on their choice of science careers. The results confirmed that males achieve higher self-efficacy scores and make more science career choices that females, even though there were no differences in their academic performance and social support. These findings depart somewhat from previous research in this field, and this may be specific to the sample and the methods used. However, this study's findings do emphasize the need for science teachers to find new ways to strengthen the development of self-efficacy beliefs in girls. Apparently, the usual mediating variables, performance and social support, do not suffice and will not resolve the existing problem of under-representation of women in science careers.

9:30 PHYSICS COURSE FOR ELEMENTARY EDUCATION MAJORS. **Beth Ann Basista, Wright State University, Dept of Physics, Dayton OH 45435.**

The current elementary education science program includes an integrated lecture and laboratory physics course designed to develop student in-depth conceptual understanding and to enable students to apply this understanding to a variety of situations. This inquiry-based course is integrated with mathematics and pedagogical content knowledge. Topics covered include position, motion, forces, energy, simple machines, and electrical circuits, with an emphasis on student misconceptions in these areas. Forms of authentic assessment (assessment of how students perform investigations, as opposed to traditional multiple choice exams) are utilized, in addition to pre-/post-testing. Pre-/post-tests include modified Force Concept Inventory and Mechanics Baseline questions. Three quarter results yield an average pretest score of 21% and an average posttest score of 72% (N=100). Modifications of the current course and development of a second physics course will satisfy the new state early and middle childhood licensure program requirements.

9:45 THE FIPSE ACCENT MODIFICATION PROJECT FOR INTERNATIONAL FACULTY AND TEACHING ASSISTANTS IN SCIENCE AND ENGINEERING. **Arthur H. Schwartz PhD, Cleveland State University, Dept of Speech & Hearing Sciences (MC 430), Cleveland OH 44115.**

This study investigated the effect of multisensory computer feedback on the speech intelligibility of international faculty and teaching assistants. Funded by the Fund for the Improvement of PostSecondary Education (FIPSE) the TEAM (Technology Enhanced Accent Modification) Project developed, tested, and evaluated a multimedia program to enable faculty and teaching assistants to reduce their accents in the classroom. TEAM developed software and instructional methodology that taught users how to monitor and modify the prosodic and articulatory features of their speech that degrade intelligibility. With the assistance of a trained tutor, faculty and teaching assistants (primarily from the sciences and engineering) learned to modify the accuracy, smoothness, rate, and tempo of their speech. The TEAM approach was evaluated on 128 international speakers at three different Ohio universities. Data were gathered on both the performance of students taught by ITAs as well as the oral proficiency of the instructors themselves. A repeated measures mixed design was used to evaluate: (1) type of accent

reduction training received; (2) student performance; and (3) oral proficiency performance before and at several intervals following instruction. The significant findings from field tests are as follows: (1) international instructors receiving TEAM performed better in the classroom than international instructors receiving traditional forms of accent modification training; (2) international instructors receiving TEAM instruction make greater gains in oral proficiency; and (3) international instructors receiving TEAM instruction have better long term retention of gains in oral proficiency.

10:00 TEACHING APPLIED ENVIRONMENTAL SCIENCE THROUGH THE INTEGRATION OF STRESSED STREAM ANALYSIS AND GEOGRAPHIC INFORMATION SYSTEMS. **Dr. Karl F. Korfmacher, Denison University, Environmental Studies Program, Granville OH 43023.**

Stressed stream analysis (SSA) is an approach that identifies subbasins and streams within a watershed impacted by point and non-point source pollution and assesses the sources, extent, effects, and severity of pollution. Assessing the relative impacts of pollution from point and non-point sources (real and potential) within a watershed is a complex spatial problem for students. Biological, physical, chemical, and hydrologic monitoring and analyses linked by the SSA framework are integrated with GIS simulations, expanding student assessment capabilities. Examples of GIS simulations include terrain modeling and the identification of pollutant "hotspots" within a watershed, which are used to focus monitoring efforts. SSA results from student assessments indicate at least slight impairment of water quality within the Clear Run Basin. GIS results from student modeling projects suggest that Denison University, Granville High School, and several riparian agricultural areas are significant sources of phosphorous. Integrating SSA and GIS analyses appears to be an effective teaching tool, but should be incorporated into a multiyear project in order to verify results.

The Environment: Policy and Society

02:00PM Saturday, April 24, 1999

Main Classroom Bldg. - 106

Michele Morrone - Presiding

2:00 BROWNFIELDS REDEVELOPMENT LEGISLATION AND OTHER BARRIERS TO REDEVELOPMENT OF THE BLIGHTED URBAN CORE. **Heidi Gorovitz Robertson, Cleveland State University, Cleveland-Marshall College of Law, 1801 Euclid Ave, Cleveland OH 44115.**

Many states have enacted laws to encourage redevelopment of contaminated urban properties. The laws attempt to do this by addressing one barrier to redevelopment, the environmental liability attached to contaminated urban properties. In general, the laws attempt to remove or reduce the significance of that barrier by reducing or eliminating the environmental liability risk attached to these properties. My hypothesis is that these efforts cannot encourage significant redevelopment because they fail to address non-environmental barriers to urban redevelopment. To determine whether this legislative focus on environmental liability is misplaced, I conducted a survey of Northeast Ohio businesses which decided, since the enactment of Ohio's brownfields law, either to move to a new location, or expand at an existing location. The survey asked businesses to rank the relative importance to their relocation decision of environmental and non-environmental factors. The results of the survey show that numerous non-environmental factors were of equal or greater importance to decision-makers than the environmental status of the property. Therefore, legislative efforts to encourage redevelopment of contaminated urban properties must be expanded to address non-environmental barriers to redevelopment.

2:15 AN INTERNATIONAL OVERVIEW OF ENVIRONMENTAL MANAGEMENT IN URBAN AREAS. **David J. Edelman and Paul Procee, University of Cincinnati, School of Planning, PO Box 210016, Cincinnati OH 45221-0016.**

The urban environment has emerged as a serious area of world concern since the Habitat I Conference in Vancouver in 1976, and it was given further impetus by the Rio Environmental Conference in 1992. Thus in the last twenty years, the trends of an urbanizing world and of environmental concern have been drawing closer together. While the environmental problems manifested in cities of varying size throughout the world are often similar, it is the assertion of this paper that the approaches to their solution that prove effective will be quite different from country to country and region to region. The specific focus here, then, is the urban areas of developing countries. The paper reviews the relevant literature, by first analyzing the urbanization processes of both densification and sprawl due to urban growth. The nature and intensity of the mostly physical environmental problems which emerge are then related to development stage and size. The failure in developing countries of the environmental management mechanisms critical to any understanding of the persistence of so many environmental problems at the municipal level are then discussed; and finally, a meaningful role for international organizations in supporting the design and implementation of solutions to both physical and managerial urban environmental problems is outlined. While solutions to urban environmental problems indeed vary according to the socio-cultural, legal, institutional and political nature of a region in general and a given country in particular, all solutions must have a number of common elements, which include a national commitment to the recognition and solution of the problems of the urban environment, an appropriate institutional structure, the solution of the problems at the most appropriate spatial level, a legislative and legal framework that is suitable and enforced, meaningful decentralization, metropolitan co-operation across administrative boundaries, partnership arrangements involving multiple stakeholders as appropriate, an atmosphere that encourages creative solutions, and, finally, contributions from the international community that support solutions to both the physical and managerial problems outlined in this paper.

2:30 A SOLID WASTE ASSESSMENT OF WITTENBERG UNIVERSITY. **Matthew Beversdorf, Wittenberg University, Dept of Biology, PO Box 720, Springfield OH 45504-0720.**

A pilot recycling program began at Wittenberg University in 1994. Waste audits were conducted before and after implementation of the program to assess the effectiveness of the program in representative academic, administrative, and residential buildings. The pilot program reduced the percent of recyclables found in the trash from 55 percent to 30 percent. Since then the program has expanded to other buildings on campus. This project assessed the effectiveness of the current recycling program on campus. Thirteen single day waste samples of trash from academic, administrative, and residential buildings were sorted into non-recyclables and recyclables separated into paper, glass, metal, plastic, and cardboard. These data were compared to the 1994 assessment data. Overall, the percentage of recyclables found in the trash of participating buildings has remained about the same since the implementation of the recycling program. Data show a reduction in the percentage (by weight) of recyclables found in the waste stream in residential buildings. However, academic and administration buildings show an increase in the percent of recyclables found in the trash. Trends in the types of recyclables show an increased percentage of paper and a decreased percentage of plastic, glass, and metal. Thus, further work must be done at Wittenberg University to reduce the amount of recyclables, especially paper, being thrown into the waste stream.

2:45 THE EFFECTIVENESS OF COMMUNITY-SPECIFIC REGULATIONS OF MUNICIPAL WATER POLLUTION CONTROL. **Mina Chang[1] and Anand Desai[2], [1]ADAMH Board of Franklin County, 447 E Broad St, Columbus OH 43215, [2]Ohio State University, School of Public Policy and Management, 2100 Neil Ave, Columbus OH 43210-1144.**

In recent years, considerable federal responsibility has been shifted to the local level for monitoring and enforcement of environmental standards. The relationships between the federal and local governments have undergone a number of changes. For instance, federal grants as a percentage of state and local revenues have sharply decreased; the federal government now requires greater participation from state and local governments in program design. Such changes have imposed fiscal and administrative burdens on local governments which has raised questions regarding the capacity of local governments to fulfill their new responsibilities. We explored a local government's capacity to adapt federal water pollution regulations and evaluated the effectiveness of community-specific regulations by comparing two Ohio communities: Columbus and Lima. This study used local socioeconomic variables and local agency's level of resource independence as measures of the local government's capacity. Effectiveness was measured by using multiple water quality indicators collected from both cities from 1980 to 1992. We used a blend of statistical and qualitative tools to analyze the data. We found that Columbus, having stronger capacity than Lima, has greater water quality improvements and uses more authoritative methods to regulate pollution. These findings support that 1) the local government's capacity can affect the effectiveness of the local government to regulate industrial pollution, and 2) the local government's capacity was related to the ways in which the local regulations were designed and the ways in which the punitive measures were enforced. This study provides information for policy makers to examine a local government's ability in adapting national policies, and suggests areas of local government's capacity that can be improved to rectify policy ineffectiveness.

3:00 CORPORATE SUPPORT FOR ETHICAL AND ENVIRONMENTAL POLICIES: A FINANCIAL MANAGEMENT PERSPECTIVE. **Alan K. Reichert, Cleveland State University, Dept of Finance, Cleveland OH 44114.**

A survey of large U.S. corporations was conducted to identify their support for a wide range of ethical and environmental practices. Ethical issues include whether the firm has: 1) a written code of ethics and social responsibility, 2) an ombudsman, 3) a policy on electronic network confidentiality, and 4) a self-assessment of the trend in ethical standards in their industry over the past decade. Environmental issues include: 1) a written statement on environmental policy, 2) a smoke-free work-place, 3) recycling programs, 4) efforts to influence environmental regulations, and 5) a willingness to make significant investments in waste-reduction technology. It was determined that support for both types of issues varies by industry and firm size. For example, while between 80-90% of the firms have a written code of ethics and environmental policy, the largest firms were more likely to have an ombudsman, a policy on electronic confidentiality, and to invest in waste reduction technologies. In addition, firms which operate in high precision industries, such as electronics and optics, or which deal with natural resources, such as mining, crude oil production, and petroleum refining, are more likely to have written policies regarding ethics and environmental practices. Furthermore, only about one-fourth of the firms reported that the level of ethics in their industry had improved over the past decade.

3:15 FARMLAND PRESERVATION AND SUSTAINABLE AGRICULTURE IN OHIO: GRASSROOTS AND POLICY CONNECTIONS. **Kristen M. Kordet, (Katrina Smith Korfmacher), Denison University, Environmental Studies Program, Granville OH 43023.**

A sustainable food system relies on two components: land resources for producing food and methods of food production that do not degrade land or other resources over time. While policies, organizations, and individuals have recognized the need for farmland preservation and sustainable agriculture separately, efforts have failed to address critical and beneficial connections between the two movements. Two central questions guided the design of this study. First, what

are the potential benefits of making connections between sustainable agriculture and farmland preservation? Secondly, what factors or challenges prevent these connections from occurring? The methods chosen to answer these questions focus on Ohio farmers, organizations, and agricultural policies. Qualitative interviews with Ohio farmers and representatives from agricultural organizations examined possible answers to these questions. In addition, a mail survey was taken of the members of Innovative Farmers of Ohio, a farmer led network for sustainable agriculture. Preliminary results support the view that (1) the lack of connection exists on the individual, organizational, and policy levels, and (2) a unified approach would be beneficial to both movements for economic, social, and environmental reasons. Identification of sustainable farmers' preferred information sources and means of exchange offer potential avenues for partnership. These conclusions are discussed in light of current frame alignment, social networking, and grassroots organization literature. In particular, the potential role of grassroots organizations in bridging sustainable agriculture and farmland preservation are explored.

3:30 ADULT ENVIRONMENTAL LITERACY IN OHIO. **Michele Morrone PhD, Karen Mancl PhD, and Kathleen Carr PhD, Ohio University, School of Health Sciences, Athens OH 45701.**

Environmental literacy is not environmental awareness, despite the fact that researchers have traditionally used awareness tests to measure literacy. The purpose of this research was to measure environmental literacy in Ohio adults in a way that reflects knowledge about, rather than concern with, the environment. The instrument was developed with the input of experts and implemented in the form of a telephone survey during the summer of 1998. Results of the survey suggest that Ohioans generally have high levels of knowledge about important ecological principles, although levels vary significantly among groups. Group differences in literacy are noted on the basis of race, income level, education, and self-reported concern for the environment.

3:45 THE CURRENT STATUS OF EMPIRICAL RESEARCH ON ENVIRONMENTAL JUSTICE. **William M. Bowen, Associate Professor, Cleveland State University, Levin College of Urban Affairs, Cleveland OH 44115.**

A body of literature claiming to have empirically documented disproportionate exposure to and negative health impacts from environmental risks in minority and low-income communities has become influential among policy and administrative decision-makers in the United States. This paper systematically reviews this literature in light of empirical research methods in social science. The conclusions are that the empirically valid and scientifically sound evidence is sparse and wholly inconclusive and that the problem has not been thoroughly and systematically researched and documented prior to making related decisions.

4:00 OHIOANS CONSUME 10 TONS OF AGGREGATE PER CAPITA ANNUALLY. **Edie Salchow, 682 Riverview Dr #84, Columbus OH 43202.**

Soil and cement are composed of silica, recognized by the National Institute of Occupational Safety and Health (NIOSH) to cause serious and avoidable lung damage in construction workers. Yet worker health regulation enforcement is difficult at construction sites. Laws regulate erosion from construction sites in order to control storm drain sedimentation, yet enforcement of these laws is said to be still in its infancy in Ohio. With infilling, the process of building in heavily developed areas, emissions of soil and cement dust impact the resident populations, especially under conditions of drought and atmospheric inversion. That this is undesirable is recognized in California, Arizona and Minnesota, where local ordinances are applied to construction activities. The purpose of this presentation is to document the prevalence of dust generation in the Columbus area during the recent construction boom, and to publicize the solutions currently offered by Ohio vendors. Photographs taken at and near the Ohio State University reveal that the four major categories of dust generation are: (1) earth moving, (2) transport of wastes, (3) use of power tools, and (4) road drag. Literature and Internet searches identified numerous available control techniques with local vendors. Interviews of regulators and construction company officials suggested that ordinances similar to those in California, Arizona and Minnesota could simultaneously lessen the burden on storm sewers, the atmosphere and the lungs of construction workers and neighbors, and promote Ohio businesses.

4:15 BOTTOM-LINE BENEFIT PARTNERSHIP-THE URBAN FOREST AND THE DEVELOPMENT COMMUNITY: USING BOTTOM-LINE BENEFITS TO SHIFT THE PARADIGM. **Tracy L. Reiss, R.J. Laverne, and Paul Sacamano, Davey Resource Group, 1500 N Mantua St, Kent OH 44240 and Judith Caldwell and Karen Townsend, Clemson University, Dept of Horticulture, Clemson SC.**

Commercial developments, including retail stores, offices, and apartments, present a significant challenge to urban forests, since most are completed with little effort to preserve or plant trees. Much of the commercial development community's lack of interest in trees is believed to be caused by an inability to articulate the benefits of trees. The primary purpose of the "Bottom-Line Benefits" study was to identify economic motivations behind the activities of tree favorable developers at commercial sites. The project team incorporated belief analysis and message design methodologies to identify key beliefs that drive the decision-making process to preserve and plant trees. Despite difficulties with quantification, findings clearly demonstrated the presence of economic benefits. Benefits ranged between ten and forty percent of initial capital outlays. Important influences upon tree preservation and planting activities were affected by the existence of economic benefits and included the regulatory, financing, and educational environments.

Urban Pollution: Effects and Remediation

02:00PM Saturday, April 24, 1999

Main Classroom Bldg. - 104

Don R. Grubbs - Presiding

2:00 EFFECT OF CREOSOTE ON MICROINVERTEBRATE COMMUNITY COMPOSITION AND DECOMPOSITION PROCESSES. **Julie K. Blakely, University of Toledo, 2801 W. Bancroft, Toledo OH 43606.**

Creosote is an EPA-registered pesticide that protects wood from decay. Ninety intact soil cores were collected throughout May, June, and August from an abandoned wood preserving plant in Toledo, Ohio. GC/MS was used to quantify the complex mixture of carcinogenic compounds in creosote that are currently leaking into the surface and ground water. Nematodes were extracted from soil using Cobb's sieving, and mites and Collembola were extracted using heptane flotation and Tullgren funnels. By identifying the nematodes to taxonomic family, maturity indices were calculated to define the successional status of the soil community. High creosote concentration areas contained *r*-selected nematodes and large total numbers. Low concentration areas contained *K*-selected nematodes with fewer total numbers. Relative abundances of Collembola and mites were influenced more by seasonal differences than creosote concentration. We conclude that nematode communities have greater promise as bioindicators of creosote contamination than collembolans or mites. Creosote contamination occurred mostly in mineral soil with little contamination in surface litter, corresponding more with nematode than microarthropod habitat.

2:15 DEEP INCORPORATION OF PAPERMILL SLUDGE PROMOTES EXCELLENT TREE GROWTH ON ABANDONED MINESOILS. **David A. Kost, John P. Vimmerstedt, Walter D. Smith, OARDC, School of Natural Resources, 1680 Madison Ave, Wooster OH 44691.**

Establishment of vegetation on acid coal minesoils may be improved by amendment with papermill sludge, which contains organic matter and plant nutrients. We regraded two sites in Jackson County, Ohio and applied a dewatered mixture of primary and secondary sludges. We used split plot experiments to evaluate two rates (15 cm or 60 cm thick layers) of sludge and various methods of mixing the sludge into the soil: surface applying 15 cm or 60 cm without incorporation, rototilling or ripping to incorporate 15 cm of sludge, and backhoeing to 90 cm or 150 cm depth to mix in 15 cm or 60 cm of sludge. Planted tree growth was clearly best where sludge was incorporated by backhoeing. After 6 years on a clay loam site, sycamore (*Platanus occidentalis*) survival (63% or 63%) and height (5.5 or 6.0 m) were greater on both backhoed treatments compared to the 15 cm-rototilled treatment (27% survival, 2.6 m height). After 5 years on a sandy loam site, sycamore survival (53% to 60%) varied little with treatment but it was taller on the backhoed treatments (4.5 or 4.7 m) than on a 15 cm-ripped (2.9 m) or a 15 cm-surface applied (2.7 m) treatment. White ash (*Fraxinus americana*), black walnut (*Juglans nigra*), sweetgum (*Liquidambar styraciflua*), and Virginia pine (*Pinus virginiana*) also grew well in the backhoed treatments, but white pine (*P. strobus*) did not. In summary, there is potential for excellent tree growth on minesoils if papermill sludge is mixed deeply with the soil.

2:30 EVALUATION OF REMEDIAL ALTERNATIVES FOR TSCA-LEVEL PCBS IN CONCRETE. **Terry Smith, Metcalf & Eddy Inc., 2800 Corporate Exchange Dr Ste 250, Columbus OH 43231.**

A former automotive plant located in a mixed industrial/ residential community was remediated under an Administrative Order. Records indicated general plant operations, storage of electrical PCB transformers, and vandalism may have resulted in TSCA level PCB contamination over most of the site. Under the Administrative Order, total PCB concentrations were required to be remediated to levels at or below residential cleanup standards under TSCA guidelines. The concrete surfaces were the most challenging in reaching remedial cleanup goals. Five alternatives were evaluated during remediation: high-pressure power washing, high-pressure power washing using a citrus-based acid, scarifying, grit blasting, and excavation. Excavation and disposal were most effective in achieving remedial cleanup goals, but capital and disposal costs were the highest. The other alternatives were cost effective in terms of reduced capital and disposal costs, but were not always effective in meeting the cleanup objectives. In some cases, a combination of remedial alternatives were implemented to achieve financial and cleanup objectives.

2:45 EFFECT OF HEAVY METAL ON POTATO WASTEWATER TREATMENT BY PEAT MOSS/CLAY ADSORPTION WITH BIOAUGMENTATION. **Howard H. Lo, Dept of Biological, Geological, and Environmental Sciences, Youssef N. Mehtar, and Yung-Tse Hung, Civil Engineering Dept, Cleveland State University, Cleveland OH 44115.**

The objectives of this study were to investigate the effectiveness of adsorption treatment using peat moss and clay supplemented by bioaugmentation with LLMO (liquid live microorganism) for potato wastewater and to determine the effect of heavy metal on the treatment performance. Parameters used in the bench-scale laboratory study included concentration of heavy metal (copper), type and dosage of adsorbent, and wastewater strength. Results showed that the peat moss was excellent for copper removal from wastewater and the clay was very

effective in removing organic carbon from potato wastewater. The peat moss, mixture of peat moss/clay, and clay had more than 69%, 79%, and 83% TOC removal efficiency. It was observed that by increasing the dosage of peat moss, the copper removal efficiency increased while TOC removal efficiency decreased. However, as copper concentration increased, both the TOC and copper removal efficiency decreased with dosage of adsorbent. It appeared that the heavy metal toxicity would reduce TOC removal efficiency and inhibit microbial growth and bio-oxidation.

3:00 THE EFFECTS OF EXTREMELY LOW FREQUENCY ELECTROMAGNETIC FIELD EXPOSURE WHILE IN UTERO ON MOUSE DEVELOPMENT. **Timothy T. Horan and Kevin M. Walker, Xavier University, Dept of Biology, 3800 Victory Pkwy, Cincinnati OH 45207-4331.**

A number of studies have indicated that exposure to extremely low frequency (e.l.f.) electromagnetic fields may have detrimental effects on animal health and development. We studied the effects of in utero exposure to an e.l.f. electromagnetic field on the physical and behavioral development of mice. Mated female mice were randomly assigned to one of two treatment groups. Females assigned to the control group were housed in individual cages, maintained on a 12 hour light / 12 hour dark schedule, and fed commercial pellet food. They were weighed daily throughout their pregnancy and until their young were weaned at five weeks of age. Females assigned to the experimental group were treated exactly the same as the control females except that they spent their entire pregnancy housed 24 hours per day in a Helmholtz coil producing a 60 Hz electromagnetic field of 2 Gauss. On the day a female delivered her litter, she was removed from the coil. The litters were weighed daily until they were five weeks of age. Behavioral tests were performed on all pups at 14 days of age. At five weeks of age, the mice were sacrificed and the weights of their spleen, liver, thymus, and gonads were obtained. The litter size of females housed in the Helmholtz coil was significantly smaller than the litter size of the control females, and the individual pups were smaller in the experimental litters. The control mice performed the behavioral tests on day 14 significantly quicker than the experimental mice. The livers and spleens of the experimental mice were significantly heavier than those of the control mice, and this may be indicative of an immune response. The results of this experiment suggest that e.l.f. electromagnetic field exposure in utero may have behavioral and physiological effects on mice.

3:15 VEGETATION SURVEYS FOR CONSTRUCTED WETLANDS OF THE WETLAND RESERVOIR SUBIRRIGATION SYSTEMS. **Lee M. Luckeydoo, Ohio State University, 590 Woody Hayes Dr, Columbus OH 43210.**

The Wetland Reservoir Subirrigation System (WRSIS) project links agricultural fields, wetland, and a storage reservoir to help minimize agrochemical runoff and sediment delivery to streams. The three demonstration sites are located in Defiance, Fulton, and Van Wert counties in northwest Ohio, and were all constructed approximately 3 years ago. Case studies of terrestrial and aquatic vegetation development and structure on the three sites were examined. Surveys were conducted on all sites using a transect technique, and observations were made using Braun-Blanquet scales. Survey information was used in determining the relative importance factors of all species. Diversity by site using Simpson's and Shannon-Wiener indices and Jaccard's coefficient of community between sites was calculated. Defiance County had the highest species richness at 51 species, with 33% being wetland species. Jaccard's values showed low similarity between sites, with Defiance and Van Wert locations most similar at 0.3768. Overall, the sites appear to be in early stages of wetland development. Seed bank analysis of Defiance soils showed a potential of 7 additional wetland species not present during the 1998 field surveys. Using life history information on species presently on site and species available in the seed bank, a management plan using water level manipulation to encourage growth of wetland and terrestrial species that have promising water quality improvement capabilities has been developed.

3:30 REMEDIATION OF CONTAMINATED SOILS USING INSITU THERMAL DESORPTION. **Jeffrey D. Stevenson, Metcalf & Eddy Inc., 2800 Corporate Exchange Dr Ste 250, Columbus OH 43231.**

Insitu Thermal Desorption (ISTD) is an evolving technology that was applied for a period of 125 days to remediate soils contaminated with tetrachloroethylene (PCE) and other volatile organic compounds (VOCs) at an industrial facility located in Indiana. During a due diligence assessment, VOCs were detected in subsurface soils at concentrations that exceeded the Indiana Clean Up Goals for industrial properties. The extent of contaminated soils that exceeded the Clean Up Goals was delineated as an area of 150 feet by 75 feet and extended to a depth of 18 feet. The objectives of remediation were to: 1) reduce the concentration of contamination in soils to levels less than the Clean Up Goals for an industrial land use scenario, and 2) conduct remediation in a timely and cost effective manner. Remediation alternatives considered for the site included: excavation and disposal, soil vapor extraction, insitu stabilization and insitu thermal desorption (ISTD). The ISTD system was selected and consistes of 135 heater/suction wells installed at a spacing of 7.5 feet and extending to a depth of 19 feet below the ground surface. An electrical heating element was installed in each well, the treatment area was covered with silicon sheeting to prevent VOCs from offgasing, and insulation was placed to prevent heat loss. The system was energized and the subsurface soils were heated to a minimum temperature of 400 degrees F. Temperatures at the heater/suction wells were in excess of 1,300 degrees F which destroyed the VOCs in place. Confirmatory samples were collected and the concentration of PCE and associated VOCs were reduced to levels below the Clean Up Goals for industrial properties.

3:45 THE ROLE OF BACTERIAL PHOSPHATE UPTAKE IN NATURAL WATERS: DO WE REALLY UNDERSTAND IT? **Xueqing Gao and Robert T. Heath, Kent State University, Dept of Biological Sciences, Kent OH 44242.**

It is a commonly accepted view that bacteria dominate the phosphate uptake in natural waters. In contrast, laboratory studies with cultured bacteria demonstrate that net uptake only account for a small portion of the gross uptake due to the active phosphate release. Whether this holds true for bacteria in natural waters remains unknown. Using $^{32}PO_4$ uptake, ^{3}H-thymidine incorporation, and phosphorus analysis, we compared the gross and net phosphate uptake by bacteria in several mesotrophic lakes. We found that gross phosphate uptake was often 10 - 100 times greater than net uptake. While this result suggests most of the phosphate taken up was released, a pulse and chase experiment did not detect any significant release of radioactive counts from ^{32}P-labeled natural bacteria. Contradictory results show that our knowledge about the P-uptake by natural bacteria is still limited and needs to be carefully re-examined. This study is supported by Ohio Sea Grant.

4:00 STRESSED STREAM ANALYSIS AND BIOMONITORING OF THE CLEAR RUN WATERSHED, LICKING COUNTY, OHIO. **Katherine A. Krulia, (Dr. Karl Korfmacher), Denison University, Environmental Studies Program, Granville OH 43023.**

This is a research project focusing on determining the water quality potentially impacted by different land uses within the Clear Run Watershed. It is through the diversity of the macroinvertebrates that one may determine the health of the watershed, the quality of the water, and possible sources of pollution from land use within the watershed based on a comparison of sites. Samples of benthic macroinvertebrates were collected at different riffle/run areas along the streams through a process called kick sampling and then brought back to the lab for identification and used in determining the Hilsenhoff Biotic Index, Mitchell and Stapp scores, and EPT scores. Based on these procedures and index models, the overall quality of the Clear Run Watershed was deemed very good to excellent with slight impairment at the ordinal level.

Geology and Planetary Science
10:00AM Saturday, April 24, 1999
Main Classroom Bldg. - 444
Ann F.H. Graetsch Harris - Presiding

10:00 A RE-CONSIDERATION OF THE HISTORICAL REFERENCES TO THE SUPERNOVA OF 1054 A.D. **George W. Collins, II, William P. Claspy, John C. Martin, Case Western Reserve University, Dept of Astronomy, 10900 Euclid Ave, Cleveland OH 44106-7215.**

In this paper we present a sequence of astronomical events which minimize the apparent conflicts among various 11th century references to celestial events associated with the appearance of the supernova of 1054 A.D. We find that virtually all conflicts can be removed if the explosion date for the supernova is several months earlier than the commonly noted date of July 4th. The earlier date allows a number of recently noted European references to be connected to a stellar event prominent in the evening sky of April and May. An explosion date of April or early May of that year when combined with the Chinese observations suggests that the phenomena was a Type Ia supernova at the present location of the Crab Nebula. The presence of European references to an evening event only serves to heighten the mystery surrounding the lack of references to the subsequent appearance of the supernova in the morning sky during June and later. This supports the view that the absence of later European records of the morning event may be associated with the Eastern Schism of 1054 A.D.

10:15 HOW THE COAL MINING HISTORY OF AN ABANDONED DEEP MINE AIDS IN THE EVALUATION OF A SITE. **Ann G. Harris, Youngstown State University, Dept of Geology, One University Plaza, Youngstown OH 44555-0002.**

The study of the history of an abandoned deep coal mine from all available records plays a very important role in the evaluation of a site. The history of the Churchill Mine located in Liberty Township, Trumbull County of northeastern Ohio shows the type of information available. The Churchill Mine was one of the oldest mines in the region and was extensive according to the map published in the first Mine Inspector Report (1874). Accident reports indicated the "slate" roof was bad, suggesting much of the mine is probably collapsed today. The Centennial Shaft (140'?) was sunk into a room at the northern end of the slope (1876). Records indicate pillars were withdrawn (1884) in the slope portion of the mine, adding to the instability of this mine. The 180' deep Churchill Shaft is a continuation of the original Churchill Slope (1882). Additional mines are connected to the Churchill, they are the Foraker #2, Niles, High Tone, Punkin and Kline mines. All are presently filled with water. At one time the water was pumped out an old entry of the Churchill Slope for the community of Girard. Records also indicate the presence of black damp (mixture of carbon dioxide and nitrogen) in the mine. The Churchill mine complex had five entrances (1 slope, 2 main shafts and 2 air shafts) that are potential cave-in areas. Part of Interstate 80, homes, businesses and several schools have been constructed over this mine. The major concern should be over the entrances.

10:30 FRACTURES RECOGNIZED IN OHIO SOIL SURVEY PROGRAM. **Lawrence A. Tornes, Edwin Miller, Julie Weatherington-Rice and Jonathan C. Gerken, Ohio Division of Soil and Water Conservation, 1939 Fountain Sq Ct, Columbus OH 43224.**

The first comprehensive inventory of fractures in the parent materials, or C horizon, of soils was made by soil scientists who systematically made soil surveys of Ohio. Fractures have been described in the C horizon of ninety-six soil series extending across sixty-five Ohio counties. These nearly vertical structural breaks in otherwise massive materials were described as

fractures, cracks, cleavage planes, vertical cleavages, vertical seams, gray seams, partings, and coarse prismatic structure. Soil scientists were concerned about the implications of fractures in relation to soil genesis. In fact, technical editors of soil survey reports oftentimes removed references of fractures from descriptions of the C horizon since, by convention, structural breaks were considered a characteristic of soil genesis and application of the term was limited to the A and B horizon. However, in the field, fractures were seen to extend from the B to the C horizon. Presently, soil properties other than fractures, like soil structure, coatings on surfaces of peds, consistency, and calcium carbonate content are used to determine the contact between the BC or CB horizon (bottom of the soil) and the C horizon (top of the parent material). Fractures have been identified in unconsolidated soil parent material with grain size distributions of loam, silt loam, clay loam, and silty clay loam.

10:45 DETERMINING SOIL EROSION DEPTHS USING FALLOUT RADIONUCLIDES. **Everett C. Bonniwell, Gerald Matisoff, Peter J. Whiting, Christopher G. Wilson, Case Western Reserve University, Dept of Geological Sciences, A.W. Smith Building 112, 10900 Euclid Ave, Cleveland OH 44106-7216.**

Quantifying soil erosion is fundamental to the evaluation of the effectiveness of different agricultural practices at controlling erosion. The fallout radionuclides ^{7}Be, ^{210}Pb, and ^{137}Cs exhibit unique soil distributions resulting from their respective fallout histories and half-lives, and from different agricultural management practices in the region. Mass balancing radionuclide stream fluxes with their respective soil distributions yields the depth of soil erosion. Distributions of ^{7}Be, ^{210}Pb, and ^{137}Cs with depth in the soil were established for the alpine watershed of the Gold Fork River (Idaho) and the agricultural watershed of Old Woman Creek (Ohio). Sediment and radionuclide fluxes were monitored during the 1996 summer snowmelt hydrograph (Idaho), and a May 18, 1997 storm runoff hydrograph (Ohio). Erosion estimates for the Gold Fork River watershed derived from radionuclide data indicate an erosion rate of 2.3 ± 2.2 µm/yr which is in agreement with sediment budget estimates of 3.3 µm/yr. In the Old Woman Creek watershed the average erosion depth from the storm event was 9.5 ± 8.3 µm. An erosion depth of 11.4 ± 5.1 µm was associated with a traditionally tilled sub-basin and an erosion depth of 4.0 ± 3.4 was associated with a non-tilled sub-basin of similar size and position in the watershed. Fallout radionuclides provide an effective multi-parameter means for estimating soil erosion depth. Furthermore, their unique distributions in soil offer a potential means of evaluating mechanisms of erosion (e.g. rill or sheet erosion) as each geometry of erosion yields unique ratios of radionuclides in the suspended load in runoff.

Geographic Analysis

02:00PM Saturday, April 24, 1999

Main Classroom Bldg. - 444

Jeffrey J. Gordon - Presiding

2:00 ATTEMPTS TO AMELIORATE ECONOMIC CONDITIONS IN CENTRAL CITIES IN NEW JERSEY. **Samuel Thompson, 525 Carroll St. 2F, Akron OH 44304-1960.**

The United States has undergone a tremendous economic change in recent years, often at the detriment of many urban areas. It is common to observe a crumbling infrastructure, dilapidated manufacturing buildings and unemployment in many cities especially in the Northeast and Midwest. In the face of these difficulties, some states are developing programs to strengthen their central cities. The premise of this paper was to evaluate New Jersey's Urban Enterprise Zone program in terms of job creation, with an eye on expanding this study to encompass all aspects of the program. The methodology involves analysis to determine changes after the application of the enterprise zone program in central cities. First, analysis of cumulative job creation numbers over time was done. Second, means testing was done to determine the significance of the job creation in the central cities. While this is a preliminary study, it is obvious that the central cities have made substantial progress toward reducing their unemployment numbers after the application of the enterprise zone program. Also, the progress was confirmed statistically. The success shows the potential of the enterprise zone program if applied with strategic planning.

2:15 GLOBALIZATION AND STUDENTS'CLOTHING: A GEOGRAPHY OF MARKETING ANALYSIS. **Jeffrey J. Gordon, Bowling Green State University, Dept of Geography, Bowling Green OH 43403.**

College students typically have little idea of the increasingly global nature of modern economics. An exercise devised in my Geography of Marketing course focused on students' personal buying behavior, by specifically inventorying their own clothing regarding the countries of manufacture found on the labels. Students first created a perceptual inventory of their clothing, including the estimated domestic percentage vs. estimated percentages imported from specified countries. Then, they actually inventoried their clothing to generate an array by country of origin and percentage. Students were amazed at the low percentage of U.S.-made clothes in their closets, the large overall number of countries found, the representation of countries that they never even suspected, and the absence of some expected countries. They also mapped their findings, described their distributions, analyzed and interpreted spatial patterns, and predicted near future and long-term trends.

2:30 THE ENVIRONMENTAL HEALTH MATRIX - A NEW TOOL FOR ENVIRONMENTAL PLANNING IN RUSSELL TOWNSHIP, GEAUGA COUNTY. **Laura Arnold, Jay Abercrombie, Todd Crandall and Elizabeth Buchanan, Davey Resource Group, 1500 N Mantua St, Kent OH 44240 and Greg Studen, Chairman, Russell Township Zoning Commission, PO Box 522, Novelty OH 44072.**

The Russell Township Zoning Commission performed a riparian corridor, wetlands and open space protection study for the three major streams that flow through the township. The riparian corridor and specified open space were characterized using a new land evaluation methodology called the Environmental Health Matrix. Undeveloped land was characterized based on public health and safety features, ecological health, and greenway potential. The study used secondary source data, remote sensing analysis, field reconnaissance, and geographic information system (GIS) technology. The purpose of the study was to provide legally defensible scientific rationale for establishing environmental planning tools and land use controls in these critical areas in the township. Planning tools recommended to the township government included establishment of riparian buffers along the streams, an environmental overlay district, and guidelines for allowing conservation development. In addition, a community education program was implemented to inform residents about the importance of natural resources in Russell Township.

2:45 THE USE OF A NATURAL RESOURCES ANALYSIS TO CREATE A COMPREHENSIVE LAND USE PLAN AND COMMUNITY GUIDE FOR WATERSHED PROTECTION IN CARLISLE TOWNSHIP, LORAIN, COUNTY, OHIO. **Dawn M. Nighman and Laura Arnold, Davey Resource Group, 1500 N Mantua St, Kent OH 44240 and Sandra McKew, Pflum, Klausmeier & Gehrum Consultants, 15 Atterbury Blvd Ste 10, Hudson OH 44236.**

Carlisle Township in Lorain County has undertaken a comprehensive land use planning project with special emphasis on natural resource protection, watershed management, and nonpoint source pollution. The study involved compilation of natural resource data and overlay analysis using geographic information system (GIS) technology. Secondary source data mapped in GIS included soils, land use, groundwater resources, surface hydrology, wetlands, canopy cover, and floodplains. Environmentally sensitive areas were identified based on secondary source data, and recommendations were made for land use controls and environmental planning. Various land use and zoning limitations, overlay sensitivity districts, and recommended policies for construction management techniques, as well as stage development priority areas and agriculturally supportive zoning were included in the preferred implementation policies. A Community Guidebook was written to assist other townships with preparation of a comprehensive land use plan. The public education component of this project involved steering committee presentations and a community workshop on nonpoint source pollution control and natural resource protection.

3:00 SATELLITE IMAGES AND AERIAL PHOTOGRAPHS AS BASES FOR PARAMETER ESTIMATION FOR SIMULATION MODELS OF URBAN WATERSHEDS. **W.B. Clapham Jr., Cleveland State University, Dept of Biological, Geological and Environmental Sciences, Cleveland OH 44115.**

Urban environments are difficult to characterize in ecologically appropriate terms. Meaningful study areas are large, and they are more variable and fragmented than natural ecosystems, reflecting socioeconomic and historical as well as natural factors. Land use/land cover classifications are useful, but they record socioeconomic rather than ecological variables and typically reflect neither the high diversity nor the extreme fragmentation of the urban environment. Doan Brook is an urban stream on the east side of Cleveland, Ohio. Thematic Mapper and 1/2-m resolution Digital Aerial Photography were used together to characterize the roughly 60 km^2 watershed in ecological terms. A 7-band unsupervised classification of the TM image yielded 32 clusters, which were used to create a series of masks through which to describe each cluster and also to estimate ecologically meaningful parameters such as percent canopy closure and percent perviousness of the ground. The consistency of cluster definitions and parameter values were verified on the ground. The process identified several patterns with ecological significance which would have been overlooked in a more conventional classification of the satellite image. It detected parts of Cleveland's east side with more trees capable of serving as urban wildlife habitat than usual for inner-city neighborhoods, and it differentiated a range of both degrees of perviousness and degree of canopy closure within the area's residential neighborhoods. This is a useful technique for estimating parameters for simulation models dealing with these watersheds.

Engineering

02:00PM Saturday, April 24, 1999

Main Classroom Bldg. - 445

Scott C. Martin - Presiding

2:00 HISTORICAL DEVELOPMENTS OF WORLD INFRASTRUCTURE. **Demeter G. Fertis, Emeritus Professor, University of Akron, Dept of Civil Engineering, Akron OH 44325-3905.**

The research in this paper includes well-documented discussions and interpretations of the historical evolution of our infrastructure, with emphasis on science and technology, and the impact of such evolutionary changes as time progresses. It starts with early historic and prehistoric civilizations some 15,000 years ago and ends with recent global developments and future trends. The research approach illuminates how humanitarian, scientific, technological, and philosophical

developments rather than survival instinct, formed the basis of each period's particular and unique infrastructure. By subdividing the whole spectrum of 15,000 years of history into six major periods and concentrating in each period on major events, the impact of such events on the evolutionary process of the infrastructure is examined. Knowing what the past was helps in understanding what the present provides and what the future will bring. In each period the major events considered may be scientific, technological, political, socioeconomic, or of any other nature, as long as they are proven to have a major impact on the evolutionary process of the infrastructure. Considerable emphasis was also given in the research of future trends in order to get some fair idea as to what the shape and nature of our future infrastructure will be. Our younger generations need to know what lies ahead and the challenges they will face.

2:15 PRACTICING PROJECT MANAGERS INSIGHTS ON PROJECT MANAGEMENT AS A PROFESSION. **Alan D. Smith, Robert Morris College, Dept of Quantitative and Natural Sciences, Pittsburgh PA 15219-3098.**

Project Management, as a discipline of study, deals in the explanation of conceptual and quantitative approaches used to manage nonrepetitive tasks within the organization's constraints of time, cost, and performance. Several institutions have adopted business coursework in the scope of Project Management within the business disciplines. Area professionals in the metropolitan Pittsburgh SMSA were surveyed concerning interest in pursuing coursework in and relative importance of project management and work efforts as defined by the Project Management Institute (PMI). After a follow-up letter, a total of 50 out of 210 (23.8%) responded to the questionnaire. A few of the highlights of the survey included the following: 68% of respondents thought more than half of their job involved project management; 56% felt more than half their subordinates do project management work; 64% would recommend graduate training in project management; and many respondents were interested in learning (90% or higher) topical areas such as scope management, time management, quality management, cost management, communication management, contract/procurement management, project monitoring, and project control.

2:30 THE DISTRIBUTION OF SEDIMENT DEPOSITS AND ASSOCIATED CONTAMINANTS IN THE MAHONING RIVER. **Scott C. Martin and Robert A. Williamson, Youngstown State University, Dept of Civil/Environmental & Chemical Engineering, Youngstown OH 44555.**

The Mahoning River has a long history of heavy industrial use. While the steel mills that once lined its banks are now mostly closed and water quality has improved markedly, the river's bottom sediments are still severely contaminated. In November 1997, the U.S. Army Corps of Engineers, Pittsburgh District, initiated a study of the feasibility of sediment remediation and ecosystem restoration in a 34 mile reach of the Mahoning River. The Reconnaissance Phase of this study, completed in December 1998, involved a survey of the volume of sediment deposits, TCLP analyses on 34 sediment samples, chemical profiles on 9 sediment core samples, an evaluation of the ecological benefits of remediation, and preliminary estimates of remediation costs. Youngstown State University conducted the survey of sediment deposits in the summer of 1998 using a canoe and poles to perform sediment depth measurements along over 500 transects across the river within the project area. A total sediment volume estimate of 475,800 cubic yards was obtained. The heaviest deposits were found in the vicinity of Niles and Girard; the volume of deposits was small in the Warren area and intermediate in the Youngstown area. The majority of sediment deposits are located within 30 ft. of the river banks. The center of the river channel is well scoured over most of the project area. Vertical profiles of heavy metals, PAH, PCBs and pesticides indicate that surface sediments are as contaminated as deeper sediments. This suggests that the river is experiencing no net deposition of sediment. The values of various biotic indices show that the fish and invertebrate populations are under severe stress in the industrial portion of the river. However, since none of the allowable contaminant limits were exceeded in the TCLP tests, it appears that the bottom sediments would not be classified as hazardous waste.

2:45 FLOW AND BIOREMEDIATION MODELING TO SUPPORT SEQUENTIAL EX-SITU REMEDIATION OF A CONTAMINATED SOIL PILE. **Fehmidakhatun A. Mesania and Aaron A. Jennings, Case Western Reserve University, Dept of Civil Engineering, 10900 Euclid Avenue, Cleveland OH 44106-7201.**

The main objective of this study is to develop a remediation analysis tool which can analyze a sequence of remedial actions applied ex-situ to an encapsulated contaminated soil pile. The model is based on a soil pile holding the contaminated soil, which has been excavated from its original site, placed on a bottom liner system and encapsulated. The liner system will contain and isolate the soil and provide ports for controlling air and water flows into and out of the soil. Once the pile has been constructed and encapsulated, the contaminated soil can be remediated by applying a sequence of remediation treatments such as vapor extraction, bioremediation, soil washing and thermal enhancement. Focus will be given to the bioremediation module which simulates the impact of bio-reactive and chemically interactive species. The bioremediation module requires a fluid flow model to simulate gas and liquid flows into and out of the encapsulated soil pile. Once flows are known, a multicomponent, convective, dispersive, bio-reactive and sorptive mass transport model, is applied to track the fate of organic contaminants undergoing aerobic/anaerobic metabolism. The ultimate goal of this work is to create a software package that will help remediation engineers consider the potential merits of an ex-situ remediation approach by analyzing combinations of process sequences and process operation to achieve the desired goals at low cost. A finite-difference solution was implemented to simulate fluid flow in the soil pile. Contour plots were generated to describe the potential field as a function of space and velocity vector plots were designed based on the Darcy's equation to simulate the flow pattern in the soil pile. The velocity vector plots will help users improve designs for sources/sinks and quantify convection for convective, dispersive mass transport (CDMT). The bioremediation module was developed by creating two CDMT solutions. The first one is a conservative solute model which simulates non-interactive mass transport within the soil pile. This was used as a basis of comparison to gauge the impacts of bio-reactive and chemically interactive species. The second simulation is of a multi-component, convective, dispersive, bio-reactive and sorptive mass transport which is intended to track the fate of organic contaminants undergoing aerobic metabolism. The mass transport models illustrate the propagation of the contaminated plume in the domain at different time steps.

3:00 PHENOLIC WASTEWATER TREATMENT BY RBC PROCESS. **Yung-Tse Hung, Mario G. Cora, Civil Engineering Dept, Howard H. Lo, Dept of Biological, Geological, and Environmental Sciences, Cleveland State University, Cleveland OH 44115, Ruth Yu-Li Yeh, Ming-Hsin Institute of Technology, Chemical Engineering Dept, Hsinchu, Taiwan.**

This paper examines the application of the rotating biological contact (RBC) process in the treatment of phenolic wastewaters. Phenolic substances are a major constituent in industrial processes such as the coke processing industry, as well as the olive oil industry. There is a general consensus that industrial wastewaters containing phenolic substances are difficult to degrade. In many cases, biological processes have shown the capability of acclimating and stabilizing phenolic wastes containing high concentrations of phenols. The study used a four stage cross flow laboratory RBC in treating synthetic phenolic wastewaters. The parameters examined included phenol concentration, phenol loading, hydraulic loading, disc rotational speed, and water temperature. A first order reaction with an average rate constant of 0.10-0.13 h^{-1} at a temperature range between 20.5-27.0°C was obtained for the biological degradation of phenolic wastewater. The overall phenol removal efficiency ranged from 95 to 99% for an input phenol loading rate of 6 to 1 g/m^2-day at a rotational speed of 3.7 rpm. The optimal removal performance was obtained at the end of the second stage with a rotational speed of 3.7-10 rpm. It is concluded that phenolic wastewaters with a phenol concentration of up to 420 mg/l can be treated efficiently in a four stage cross flow RBC reactor.

3:15 DOMESTIC WASTEWATER TREATMENT WITH PLASTIC MEDIA BIOFILTER. **Yung-Tse Hung, Shue-Yen Tsai, Civil Engineering Dept, Hao-Che Howard Pu, Dept of Computer & Information Sciences, Howard H. Lo, Dept of Biological, Geological, and Environmental Sciences, Cleveland State University, Cleveland, Ohio 44115, Hana Salman, Environmental Engineering Dept, Tishreen University, Lattakia, Syria.**

This paper examines the use of plastic foam biofilters in the treatment of domestic wastewaters. Simple treatment methods have been used to treat the wastewater for small communities. Peat percolator, bark and wood chips could be good percolator material for direct treatment of domestic wastewaters due to the low cost, high reliability, and low operation technique requirements for the on-site treatment. Those adsorbent materials have excellent BOD, TSS and bacteria removal efficiency and can operate well in a severe weather condition such as Alaska. However, the clogging of media could be a problem. The study used plastic foam media biofilters in the treatment of domestic wastewaters with long hydraulic detention time, and large surface area and high organic loading rate. At an organic loading of 196 (gallons/day)/sq ft and temperature of 23° C, BOD removal efficiency of 93.5% using natural ventilation was obtained, and was 98.4% using forced ventilation. The total coliform removal was 99.998% for both cases. At temperature of 8-10° C, the BOD removal efficiency was 87.5%, TSS removal efficiency was 80 %, and total coliform removal was 87.8%. The effluent contained 16.8 mg/l BOD, 5 mg/l TSS, for an influent containing 144 mg/l BOD and 28 mg/l TSS. It is concluded that plastic foam biofilters can be used as a low cost method for domestic wastewater treatment in rural communities.

3:30 MUNICIPAL WASTEWATER TREATMENT WITH A TRICKLING FILTER. **Yung-Tse Hung, Supara Leaungpattarawong, Chatchawal Lerssupochawanich, Civil Engineering Dept, Howard H. Lo, Dept of Biological, Geological, and Environmental Sciences, Cleveland State University, Cleveland, Ohio 44115, Ruth Yu-Li Yeh, Chemical Engineering Dept, Ming-Hsin Institute of Technology, Hsinchu, Taiwan.**

This paper examines the application of a trickling filter in the treatment of municipal wastewaters. A trickling filter has been used in the treatment of both industrial wastewaters and municipal wastewaters. Polyvinylchloride (PVC) was used as the packing media in the trickling filter with 2 m height and 0.2 m diameter. The settled domestic sewage was used as the feed in this study. The influent flow rate was from 0.2 to 0.5 L/min and the temperature was from 16.5-17.5° C. Two types of media used included sunken media and floating media. The results indicated that COD removal efficiency ranged from 60-75% for the sunken media and 71-85% for the floating media trickling filter at a feed rate of 0.2 L/min. At a high feed rate of 0.5 L/min, the COD removal efficiency reduced to 36% for sunken media and 40% for floating media trickling filter. The influent contained 150 mg/l soluble COD, 292 mg/l total COD, 102 mg/l TSS, 21.2 mg/l ammonia, and a pH 7.2. The media rate constant was found to be 0.92 and 1.13 for the sunken and floating media, respectively. The results indicated that floating media had a better performance than that for the sunken media and that the influent flow rate had an important effect on the COD removal efficiency. The trickling filter can be used in treating municipal wastewater efficiently.

3:45 A NEW APPROACH TO DIVERSITY COMBINING IN WIRELESS DS\CDMA COMMUNICATION. **Okechukwu C. Ugweje, University of Akron, Dept of Electrical Engineering, Akron OH 44325-3904.**

The use of a diversity receiver is one of the most efficient methods of mitigating the effects of multipath fading in wireless communication. Diversity protection against multipath fading is obtained by combining the signals received on several antenna branches, assuming that the received signal at each antenna branch is independently faded. With the ever-increasing growth

of the wireless communication industry, the need for increased reliability of the radio link is more important now than ever. This paper describes the design and performance analysis of a novel diversity combining technique for the Direct Sequence-Code Division Multiple Access (DS-CDMA) communication. Combining the concept of Maximal Ratio Combining (MRC) and selection diversity, a new technique is derived and analyzed for a Rayleigh fading channel. Our analysis includes both selection diversity and MRC as special cases. In this design, the receiver inputs are divided into groups and each group selects either one output or multiple outputs depending on the selection process. Each group of antennas may be located at a different position receiving information independently. The decisions of individual antenna groups are then combined to obtain the final decision. This technique can be used for a large array of antennas, or for a distributed antenna configuration. It is shown that by dividing the receivers into groups, the full benefit of diversity is attainable. System performance is evaluated in terms of the average Bit Error Rate (BER) and outage probability. Numerical results are presented to show the performance of the system.

4:00 CONTROL-ORIENTED MODELING OF ADVANCED LARGE ORDER ROTORDYNAMICAL SYSTEMS. **Biao Yu, Kenneth R. Bischof, Lalit K. Balijepally, J.T. Sawicki, Cleveland State University, Fenn College of Engineering, Dept of Mechanical Engineering, Cleveland OH 44115.**

The finite-element based models of most realistic rotordynamic systems produce too many degrees of freedom - "too many" not only from the computational point of view (e.g., developing transient solutions), but also more importantly, from the control's point of view. The development of analysis and design tools for modeling and control of advanced rotordynamic systems is the major thrust of this research work. Effective balanced realization techniques are applied for modeling and control design of rotor-bearing systems with small gyroscopic effects. The system model is converted into a state-space representation and the degree of observability and controllability of each state is analyzed to create the smallest-size model that best captures the dynamics of the system. This approach, as well as the procedure for the design of the reduced-order controllers, is illustrated by a finite-element based model of a typical rotor-bearing system. The unique, magnetically levitated rotor test rig will be employed for future experimental verification of simulation results. The description of the unique features and capabilities of the magnetic rig will be presented.

4:15 EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF RUB INTERACTIONS IN ROTORDYNAMICS. **Kenneth R. Bischof, J.T. Sawicki, Biao Yu, Cleveland State University, Fenn College of Engineering, Dept of Mechanical Engineering, Cleveland OH 44115.**

Presently, there is an ongoing search for improvements in the operational life, efficiency, maintainability and reliability of high performance rotating machinery. With the continued/(never ending) increase in workload and speed requirements, the call for rotating machinery design improvement and diagnostics becomes even greater. This paper presents some initial results from analytical and experimental studies on the dynamic behavior of rotors interacting with stationary components. Numerical simulations demonstrate the rotor vibration spectrum rich in subharmonic, quasiperiodic, and chaotic vibrations. The nonlinear calculation techniques are applied to demonstrate the changes of the vibration waveforms for different rotor operational regimes. Initial experimental results demonstrate different aspects of nonlinear rotor behavior. The results are interpreted using advanced signal processing techniques. The design of the rotor test rig for the advanced rub-related experimental study is presented and described. This unique facility was designed and built for the purpose of explorative advanced studies on high-speed rub phenomena in rotating machinery.

4:30 ADVANCED HEAT TRANSFER ANALYSIS TOWARDS THE EFFICIENT DESIGN OF A RECIPROCATING COMPRESSOR CYLINDER HEAD. **Biao Yu, J.T. Sawicki, Kenneth R. Bischof, Cleveland State University, Fenn College of Engineering, Dept of Mechanical Engineering, Cleveland OH 44115.**

The purpose of this research was to apply advanced computer and analytical techniques to redesign the cylinder head of a reciprocating air compressor for more efficient operation dictated by heat transfer phenomena. During the duty cycle of the compressor, large amounts of heat are generated due to the compression of the air and friction of the mating components, e.g., piston rings. Since the excessive temperatures can result in a damage of the compressor components, it is quite critical to dissipate the heat efficiently, and thus keep the operating temperature of the compressor head as low as possible. Therefore, the major task was to reduce the operating temperature of the cylinder head and the output temperature of compressed gas in the compressor. Several factors such as cooling network configuration, head geometry, materials, etc., which affect the heat transfer efficiency in the cylinder head, were analyzed using 3D thermal and fluid mechanics computer models. Advantages and disadvantages of their applications to industry will be fully discussed.

4:45 UNSTEADY FLOW IN A STATOR BLADE ROW INTERACTING WITH UPSTREAM MOVING WAKES. **Lalit K. Balijepally and Rama Subba Reddy Gorla, Cleveland state University, Dept of Mechanical Engineering, Cleveland OH 44115.**

A Finite Difference Computational Method has been used to study the unsteady flow arising from the wake-stator interaction in turbomachinery. The numerical results obtained in this investigation, regarding the wake-stator interaction, will provide an insight into the mechanics of the unsteady flow and demonstrate the potential for controlling its effects. The unsteady flow leads to significant fluctuations of the blade loading and influences heat transfer, separation and boundary layer characteristics. Turbomachinery designers could benefit from controlling the undesirable aspects of the unsteady flow in order to enhance a reliable and quiet operation. The results indicate that there exists a magnification of the turbulent pressure fluctuations on the suction side of the blade and a comparison of numerical with experimental data will be presented.

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